AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING

Civilian and Defense

DECEMBER 1, 1951

In This Issue . . .

Automatic Handling of Parts

Dual Range Hydra-Matic for Pontiac

Development of Power Steering

Balancing Engine and Torque Converter

Italian Version of the Jeep

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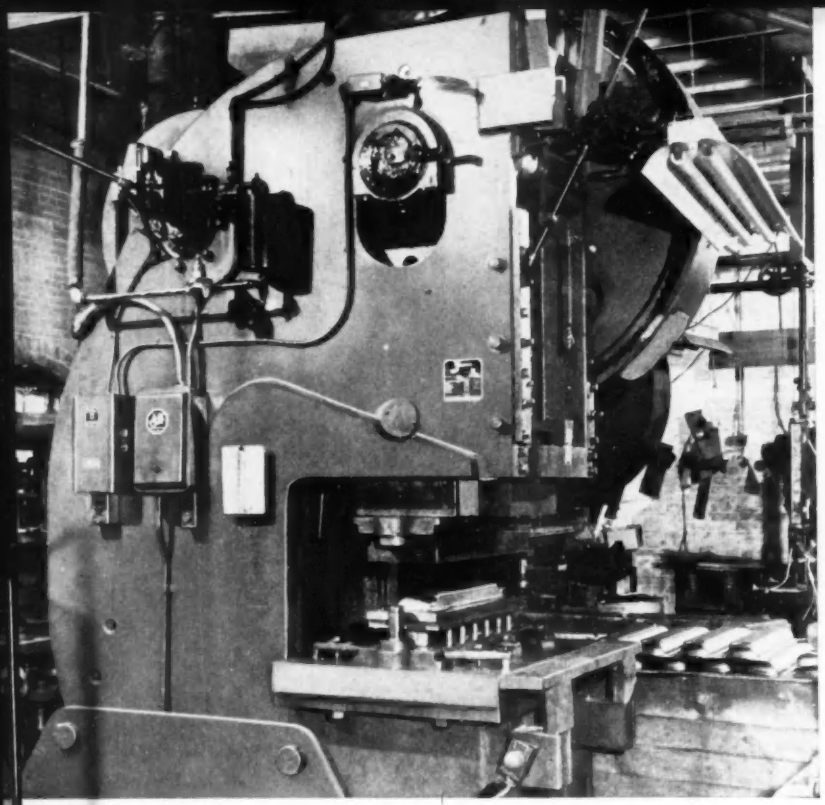
A CHILTON PUBLICATION



What's YOUR problem?

Wesley L. Tharp, with headquarters in Indianapolis, is the Standard Oil lubrication specialist who recommended STANOSTAMP Compound "C" to this midwest lamp manufacturing company.

Specially trained and experienced Standard Oil lubrication specialists are located in strategic spots throughout the Midwest. There's one near your plant, ready to give you the benefit of his experience.

You can obtain his prompt, on-the-spot service by phoning or writing to your local Standard Oil office. And when the specialist calls on you, ask him about these other fine Standard Oil products.

STANICUT Cutting Oils. These special-duty cutting oils meet today's most exacting requirements and highest production schedules. Grades vary in viscosity and compounding. Each contains the correct proportion of extreme-pressure and friction-reducing ingredients.

STANICOOL HD Soluble Oil. Because of additional compounding, this heavy-duty soluble oil possesses the cooling ability of an emulsion and also gives better tool life and finer finishes than do conventional soluble oils.

STANOLEX Oils. Due to superior wetting ability, these oils are useful on bearings which are inclined to rust during shutdown, or because of high humidity. They are recommended for lubrication of ways and guides on machine tools which are prone to chatter when straight mineral oils are used.

Beats trouble to the draw...

Drawing lamp shades from 20 gauge, cold-rolled steel proved troublesome for the General Lamps Manufacturing Corporation of Elwood, Indiana. Rejections averaged 15%. In addition to this costly scrapping, finish was not satisfactory. It was difficult to remove the die lubricant from the completed shades. Dies had to be polished frequently.

Operators sought a die lubricant which could remedy their production slow-up. Of a number of products tried, STANOSTAMP Compound "C"—the recommendation of a Standard Oil lubrication specialist—gave the best results.

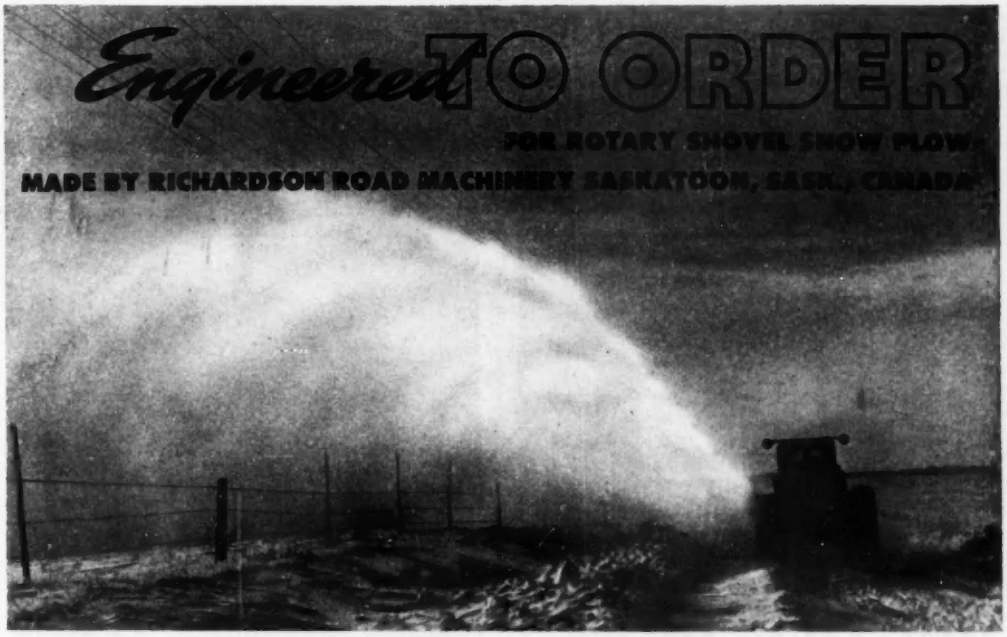
Use of STANOSTAMP "C" has cut rejections from 15% to less than ½%. Excellent finish has been obtained on the shades. Cleaning of dies has taken minimum time and labor. As a result, STANOSTAMP has helped boost production by more than 15%.

Stanostamp
REG. U.S. PAT. OFF.
Compounds

Discuss the advantages of STANOSTAMP Compounds and Standard Oil cutting oils with a Standard Oil lubrication specialist. His headquarters are near your plant. How you can benefit from his services is explained at the right.

Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD



"Over the fence is the place for snow" says Richardson Road Machinery. Above is the Richardson Rotary Shovel Snow Plow Model 872M (mounted on an Allis Chalmers Motor Grader) which throws snow from 50 to 60 feet.

Power from the auxiliary Diesel motor, located on back of frame, is transferred through a Cotta Gear and Clutch Reduction Unit specially engineered for the Richardson application.

Cotta Reduction Units are being used on cranes, shovels, rock crushers, generators, pumps, etc. Broad range of ratios. Input torque from 150 to 1350 foot pounds. Diagrams, capacity tables, dimensions, and complete specifications sent free on request. State your problem — COTTA engineers will help you select the right unit for best performance. Write today.

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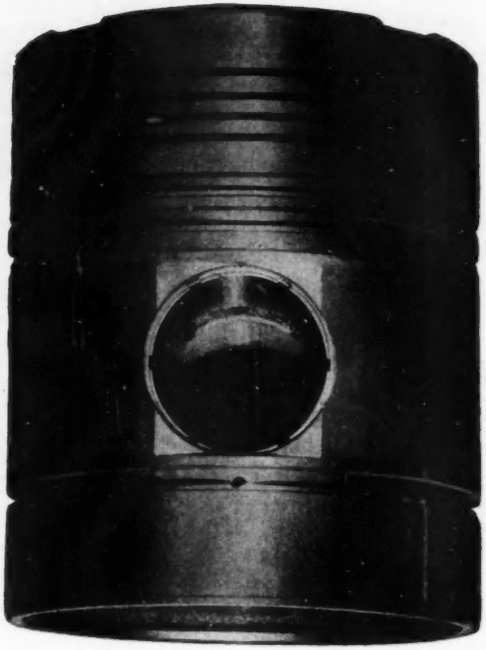
GEAR AND CLUTCH
REDUCTION UNIT
PRECISION-BUILT • SPECIALLY ENGINEERED FOR YOUR PRODUCT



DUCTILE IRON Improves Diesel-Engine Pistons

50-pound piston cast in Ductile Iron. At the left is a section. Tests show:

TENSILE STRENGTH .....65,000 p.s.i.
YIELD POINT .....53,000 p.s.i.
ELONGATION 9.5%

Hydrostatic Destruction test over 18,000 p.s.i.
(Same test on Class 40 iron — 13,000 p.s.i. ultimate.)

Provides High Strength/Weight Ratio along with Outstanding Resistance to Mechanical Wear and Heat

Ductile Iron is a cast ferrous product that combines the *process advantages* of cast iron along with many of the *product advantages* of cast steel...

In less than two years, ductile iron has attained wide acceptance because it offers excellent castability, high mechanical properties, and good machinability. Parts cast in ductile iron show superior pressure tightness, good elastic modulus and resistance to shock.

High yield strength in combination with toughness renders this new engineering material ideal for automotive and allied services.

TYPICAL CURRENT APPLICATIONS: crankshafts, wrenches, manifolds, fender dies, pumps, clamps, compressor heads, anvil blocks for forging hammers, and other parts too numerous to detail.

AVAILABILITY: Send us details of your prospective uses, so that we may offer a list of sources from some 100 authorized foundries now producing ductile cast iron under patent licenses. Request a list of available publications on ductile iron... mail the coupon now.

The International Nickel Company, Inc.
Dept. AI, 67 Wall Street, New York 5, N. Y.
Please send me a list of publications on: **DUCTILE IRON**

Name.....Title.....
Company.....
Address.....
City.....State.....

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

AUTOMOTIVE INDUSTRIES

Published Semi-Monthly

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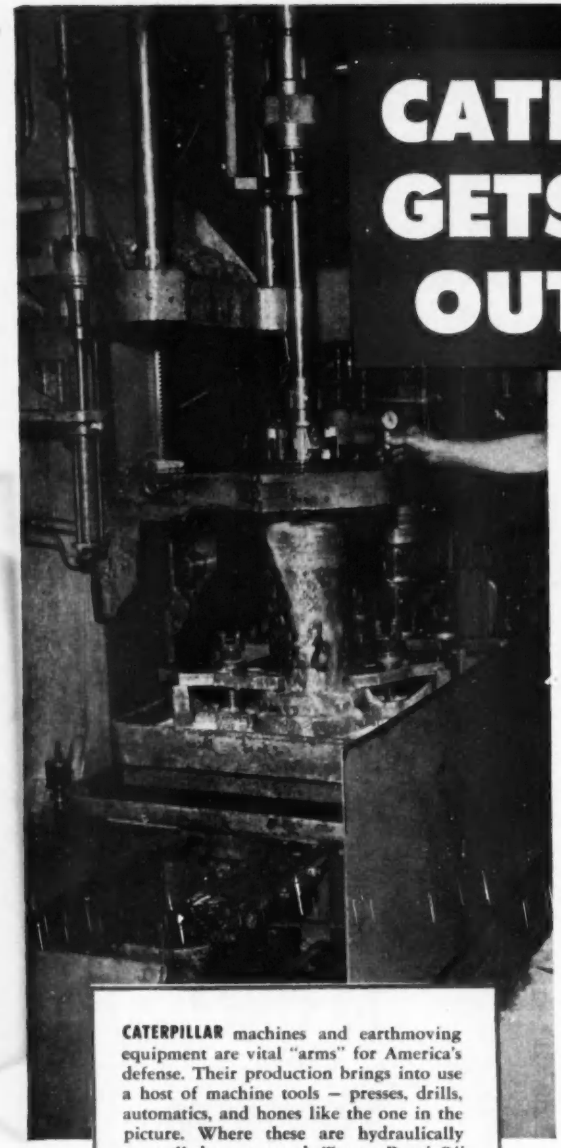
CATERPILLAR GETS ORDERS OUT FASTER



CATERPILLAR machines and earthmoving equipment are vital "arms" for America's defense. Their production brings into use a host of machine tools — presses, drills, automatics, and hones like the one in the picture. Where these are hydraulically controlled or operated, *Texaco Regal Oil (R&O)* as the hydraulic medium assures clean, trouble-free operation.

...with the help of TEXACO REGAL OIL (R&O) in hydraulic mechanisms

To maintain production and meet delivery dates, machines at Caterpillar Tractor Co.'s plants *must keep working*. Unscheduled stoppages of hydraulic mechanisms, for example, simply cannot be tolerated. So quality comes first in choosing a hydraulic medium. *Texaco Regal Oil (R&O)* has proved ideal.

For Caterpillar, as for other quality-wise manufacturers, *Texaco Regal Oil (R&O)* assures: 1) clean hydraulic systems; 2) smooth, uninterrupted operation; 3) protection of internal parts against rust; 4) longer operating periods between drains and overhauls; and 5) lower maintenance costs.

Texaco Regal Oil (R&O) is specially refined from choice base stocks, then processed and fortified with special Texaco additives. *Texaco Regal Oil (R&O)* is thus *more than ten times more resistant to oxidation* than ordinary turbine-quality oils, gives far greater protection against rust and sludge, and will not foam.

There is a complete line of *Texaco Regal Oils (R&O)* approved by leading hydraulic manufacturers. A Texaco Lubrication Engineer will gladly show you how they can improve performance and reduce costs in your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

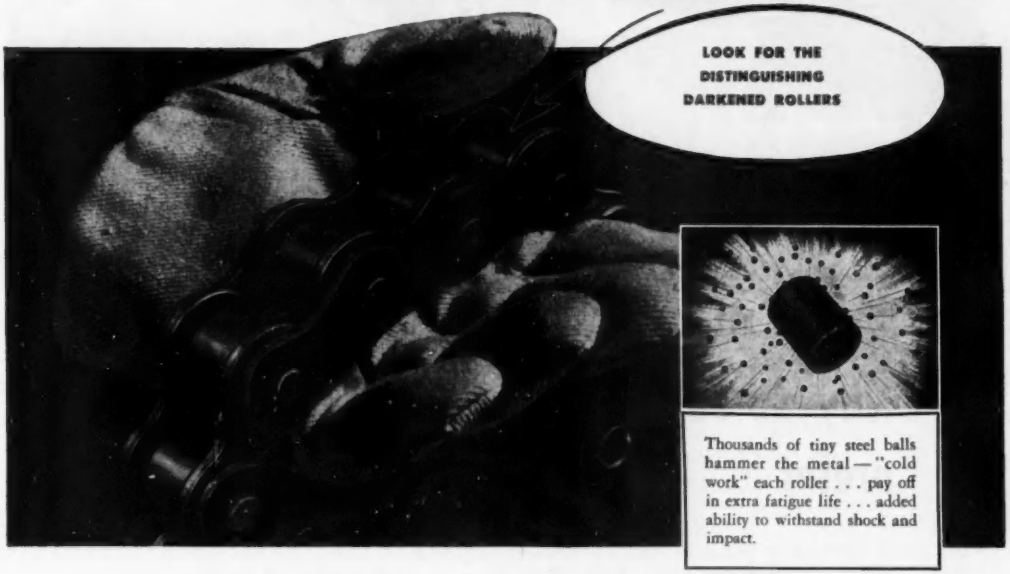
TEXACO

TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

Here's how you can tell the chain with SHOT-PEENED rollers...



Thousands of tiny steel balls hammer the metal — "cold work" each roller . . . pay off in extra fatigue life . . . added ability to withstand shock and impact.

...the chain that has extra fatigue life

YES, you want to be sure you get shot-peened rollers on the next roller chain you buy. Shot-peening gives rollers the extra fatigue life needed to take repeated shock and impact loads.

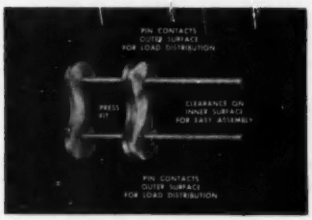
These chains are high in tensile strength, durable under severe loads, relatively light in weight and uniform in pitch. This accounts for their wide acceptance throughout industry for both drive and conveying purposes.

Thanks to constant research and precise manufacturing controls, every Link-Belt Precision Steel Roller Chain meets the highest standards for uniform strength. You get a positive, long-life drive — unaffected by heat, cold or moisture.

Link-Belt Roller Chain is available in single or multiple widths, in ⅜ to 3 in. single and double pitch. For all the facts, call your nearest Link-Belt office.

LINK-BELT

PRECISION STEEL ROLLER CHAIN



Easier coupling
and uncoupling without sacrificing load distribution

Patented E-Z Assembly feature of Link-Belt Precision Steel Roller Chain has won world-wide approval. Coupling and uncoupling of multiple width chains — right on the job — is far easier. There's absolutely no sacrifice of load distribution . . . no loss of the chain's remarkable performance. Press-fits between chain pins and middle bars have been modified. But full load carrying capacity across the entire width of the chain has been maintained.

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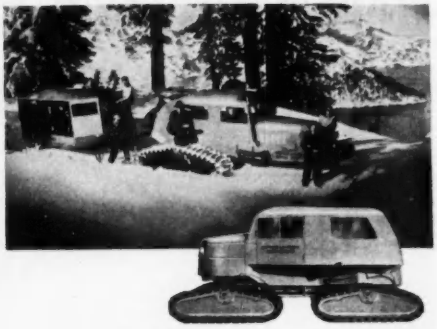
SKF-equipped Mack Manufacturing Corporation LF Chassis.

SKF-equipped Tucker Sno-Cat Corporation Model 443 "Sno-Cat."



SKF-equipped White Motor Company Super Power Truck.

why do so many prefer SKF?

It's pretty hard *not* to buy good bearings today, but SKF is the preferred bearing with many an automotive manufacturer.

There are good reasons why!

These manufacturers know SKF as a reliable, friendly supplier. They've learned to have implicit confidence in the experienced bearing engineering specialists at SKF's headquarters. They appreciate the teamwork of SKF field men who are qualified specialists in the application of bearings to vehicles.

Their customers know the value of the complete maintenance service available to them through SKF's Distributor Organization.

Whatever your product, your engineers and designers can have this helpful SKF teamwork simply by asking for it. 7287

SKF-equipped Hyster Company "40" Lift Truck.

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8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

integrity • craftsmanship • metallurgy
tolerance control • surface finish
product uniformity • engineering service
field service

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(Advertisement)

Cork-and-Rubber Gasket Materials

made to meet government specifications

You can get samples from Armstrong of materials made to meet each class of the principal government specifications covering cork-and-rubber gasket materials. These materials are listed below.

Specification	Material	Specification	Material
MIL-G-6183			
Type I Soft.....	NC-709	Type II Soft....	DC-167
Type I Medium..	NC-710	Type II Medium.	DC-100
Type I Firm....	NC-711	Type II Firm....	DC-113
MIL-T-6841.....	DK-153 / RK-304S	MIL-G-6747	DK-149

For additional data on the materials above, call your nearest Armstrong Industrial Division office or see Sweet's file for product designers.

New cork-and-rubber compounds. Armstrong's Research Laboratories are ready to develop new cork-and-rubber materials to meet new military requirements as they arise. Please discuss your needs with your nearest Armstrong representative . . . or write.

Cork compositions. There is an Armstrong Cork Composition made to meet each of the classes under Federal Specification HH-C-576, as well as each of the grades under specification MIL-C-16090.

Synthetic rubber compounds. Armstrong makes specialized synthetic rubber compounds for critical uses. Example: synthetic rubber valve washers for aircraft fuel and oil servicing nozzles made under MIL-N-4180.

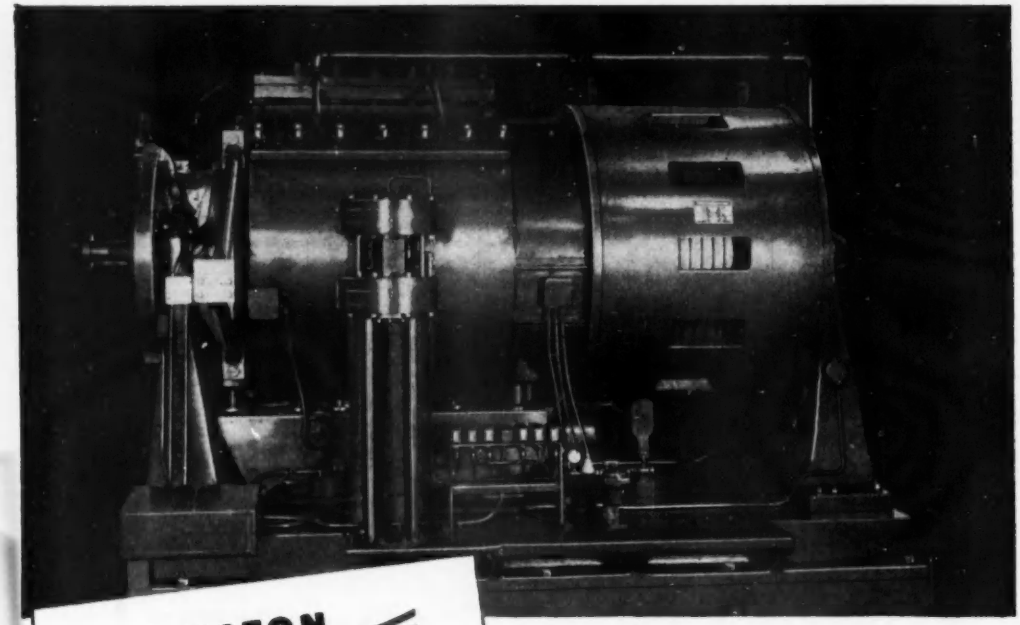
Send for this gasket manual. It contains 24 pages of information designed to help you make the best use of Armstrong's Gasket Materials. Included are discussions of subjects such as designing gaskets to reduce cost . . . practical tolerances for resilient gaskets . . . designing gaskets for efficient sealing, and others. You'll find, too, up-to-date data on cork-and-rubber, cork composition, and straight synthetic rubber gasketing materials. Included are current government specifications and tentative SAE-ASTM specifications.

See "Armstrong's Gasket Materials" in Sweet's file for product designers. For personal copy, write Armstrong Cork Company, Gaskets and Packings Department, 1512 Arch Street, Lancaster, Pennsylvania.

ARMSTRONG'S GASKET MATERIALS

Your nearest Armstrong Industrial Division office

ALBANY 10, N. Y., 64 Northern Boulevard, Telephone: 4-0131 • BOSTON 16, MASS., 131 Clarendon Street, Telephone: COpley 7-2490 • CHICAGO 54, ILL., 13-136 Merchandise Mart, Telephone: DElaware 7-0500 • CINCINNATI 2, OHIO, Temple Bar Building, 138 E. Court Street, Telephone: PArkway 3220 • CLEVELAND 15, OHIO, 209 Hanna Bldg. Annex, Prospect Ave. and E. 14th Street, Telephone: MAin 7900 • DETROIT 26, MICH., 10th Floor, Free Press Building, 321 Lafayette Avenue, West, Telephone: WOodward 3-5670 • GREENVILLE, S. C., 33 Norwood Place, Telephone: Greenville 3-5302 • LOS ANGELES 15, CALIF., 719 Bendix Building, 1206 Maple Avenue, Telephone: RICHmond 0286 • NEW YORK 16, N. Y., 295 Fifth Avenue, Telephone: MUrray Hill 4-6900 • PHILADELPHIA 2, PA., Robinson Building, Fifteenth and Chestnut Streets, Telephone: LOcust 4-4290 • ST. LOUIS 3, MO., 1205 Olive Street, Telephone: CHestnut 1757 • IN CANADA: Armstrong Cork Canada Limited, 6911 Decarie Boulevard, Montreal, Quebec, Telephone: ATlantic 4733.



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Accurate Vibration-Free Readings at All Speeds

Dynamatic Dynamometers are characterized by extreme smoothness and freedom from vibration, providing quick, accurate readings at all speeds. Convenient, positive control is accomplished with simple, inexpensive, electronic equipment. These units are extremely flexible in operation, and are adaptable to a wide range of conditions, producing very high torques at low speeds, operating easily at high speeds, and offering a smooth and infinitely adjustable range of torque. Completely self-contained A.C. operation.

Dynamatic Dynamometers are extremely simple, compact, light in weight, and moderate in cost. They are available in absorbing, motoring, and universal types. The latter provide for instantaneous switching from absorbing to motoring and back, so that friction horsepower of an engine can be determined at attained operating temperatures.

There are almost unlimited possibilities in horsepower and speed combinations; horsepowers from 5 to 5000; speeds from 100 rpm to 30,000 rpm.

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Subsidiary of EATON MANUFACTURING COMPANY, Cleveland, Ohio

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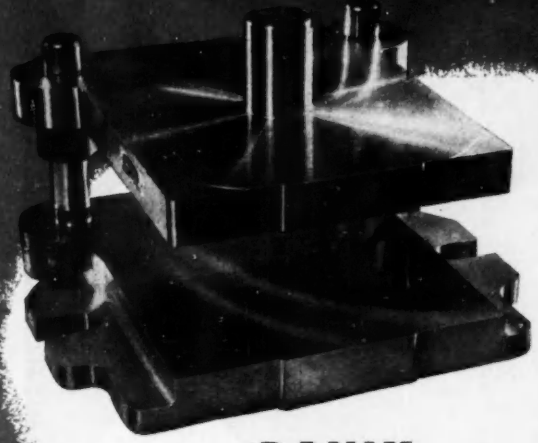

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More than 28 years of prompt, complete service has made Danly the first choice of diemakers everywhere.

Danly precision makes every Danly Die Set a reliable base for the finest die work... and every Danly Supply item a dependable time-saver.

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*Indicates complete stock

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DANLY MACHINE SPECIALTIES, INC.
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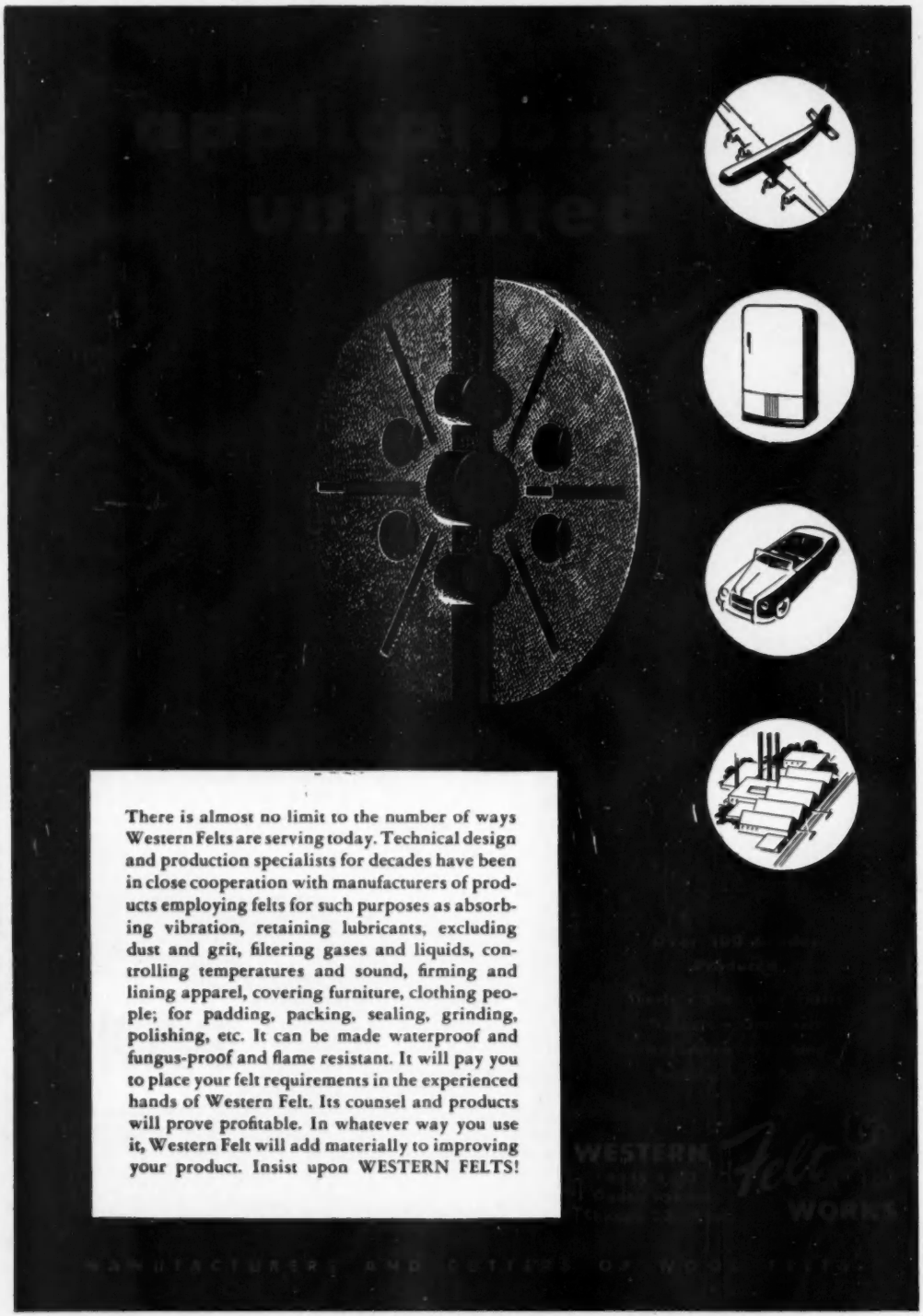
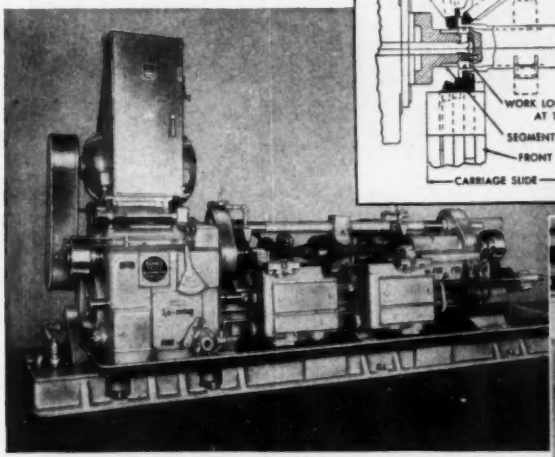
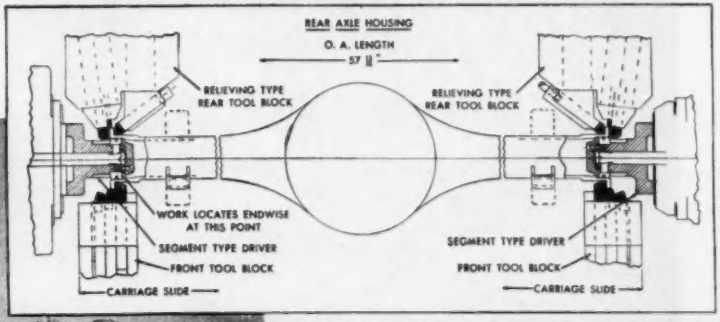
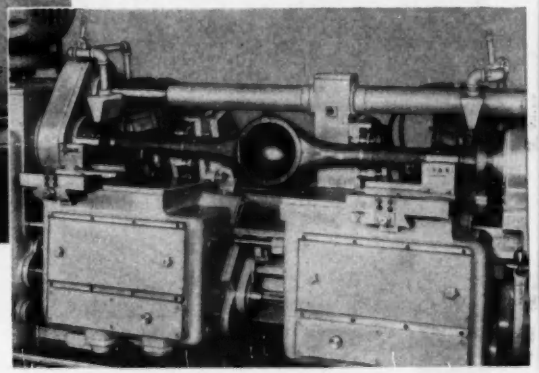

There is almost no limit to the number of ways Western Felts are serving today. Technical design and production specialists for decades have been in close cooperation with manufacturers of products employing felts for such purposes as absorbing vibration, retaining lubricants, excluding dust and grit, filtering gases and liquids, controlling temperatures and sound, firming and lining apparel, covering furniture, clothing people; for padding, packing, sealing, grinding, polishing, etc. It can be made waterproof and fungus-proof and flame resistant. It will pay you to place your felt requirements in the experienced hands of Western Felt. Its counsel and products will prove profitable. In whatever way you use it, Western Felt will add materially to improving your product. Insist upon WESTERN FELTS!
WESTERN Felt WORKS

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK







MODEL "AR" Lo-swing WITH DOUBLE END DRIVE CUTS MACHINING COSTS ON REAR AXLE HOUSING

Problem: To turn and face both ends of Rear Axle Housing simultaneously.

Solution: The Model AR Automatic Lo-swing Lathe selected for this job was equipped with a Double End Drive to secure a balanced, efficient drive and prevent torsional deflection of the Axle Housings while under cut.

The right-hand Head of the Double End Drive Mechanism is a massive, two-piece unit securely clamped to the ways of the bed. Its top part slides on large bearing surfaces and is pneumatically-operated to facilitate loading and unloading of the work. The large diameter drive shaft for this head is splined to permit free longitudinal movement of the sliding member, and is supported with a central bearing.

The close-up view above shows details of the tooling and also the two spring-loaded vibration dampeners which prevent vibration of the out-of-balance part when revolved at high speed. This view also shows the two front carriages; the left-hand carriage feeds towards the headstock while the right-hand carriage feeds towards the tailstock. The mechanism for reversing the feed on the right-hand carriage is enclosed in the housing shown on the extreme right-hand end of the bed in the overall view above.

The axle housing is driven with two pneumatically-operated expanding segments...the air operating cylinders being mounted directly on the right and left hand Driving Head Spindles. Details of the tooling are shown in line drawing.

The operating cycle consists of loading the Axle Housing in two cradles, after which the sliding member of the right hand head advances and locates the housing endwise in relation to the driving chucks. This first movement is controlled by a four-way air valve at the right hand end of the machine. The second movement of this valve closes the two driving chucks. The machine is then started with the main clutch control lever located on the right side of the right-hand carriage, which is the normal operating position.

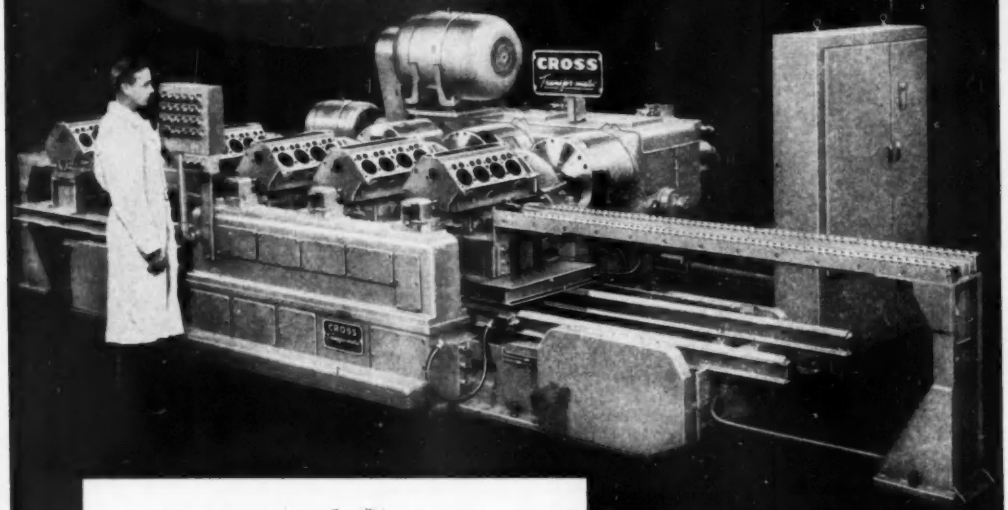
The automatic machining cycle then takes place and the machine stops automatically at the end of the cycle, ready for unloading and reloading. Consult Seneca Falls Engineering Staff on your turning problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

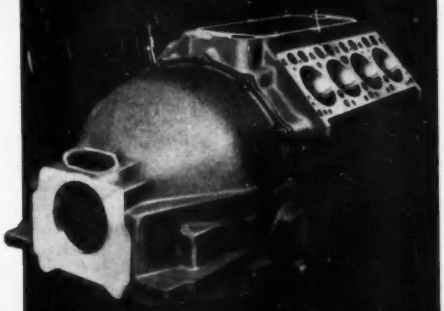
PRODUCTION COSTS ARE LOWER WITH Lo-swing

Another Transfer-matic by Cross

Bores and Faces Flywheel Housing and Cylinder Block Assemblies



- ★ 81 pieces per hour (three at a time) at 100% efficiency.
- ★ Bore transmission hole and face transmission face; concentric and square with crankshaft bores.
- ★ Automatic mechanism transfers work from incoming conveyor to machining station and from there to outgoing conveyor.
- ★ Pre-set tools for quick changing
- ★ Other features—automatic power operated locating and clamping; automatic balancing mechanism for cross facing slides; independent hydraulic feeds for boring and facing; J.I.C. standard construction with stranded wire.



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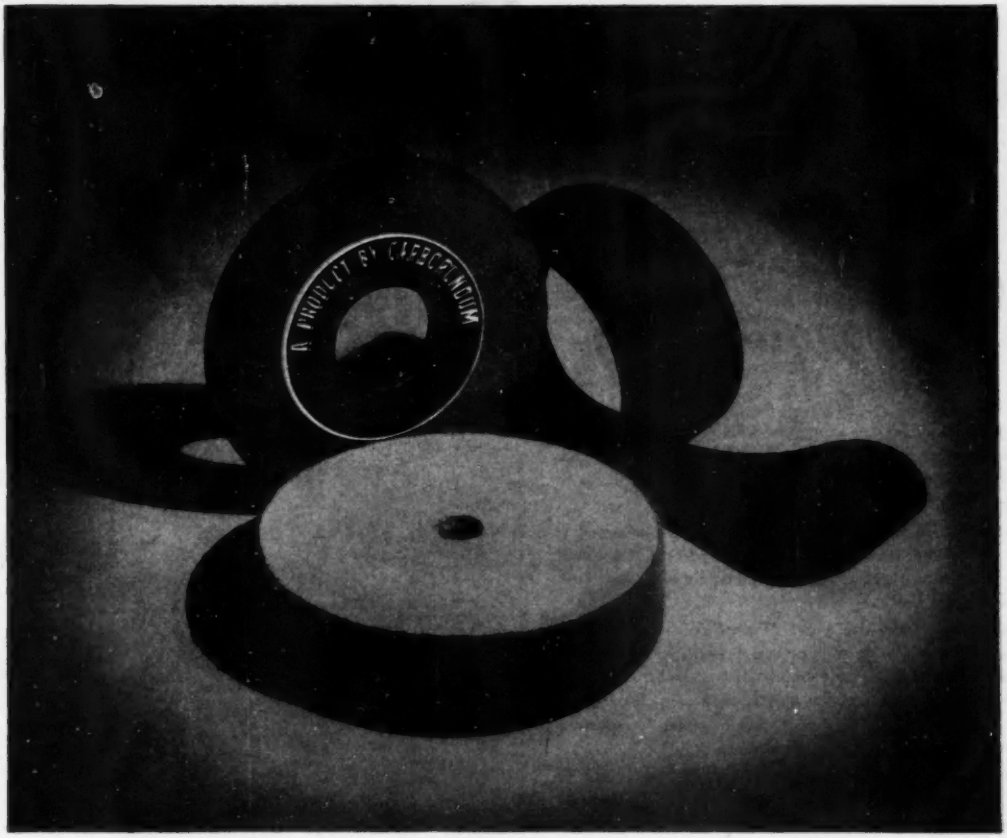

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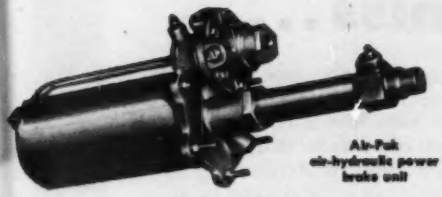
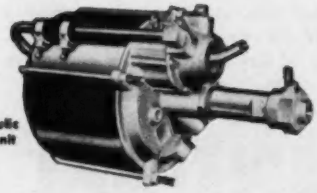
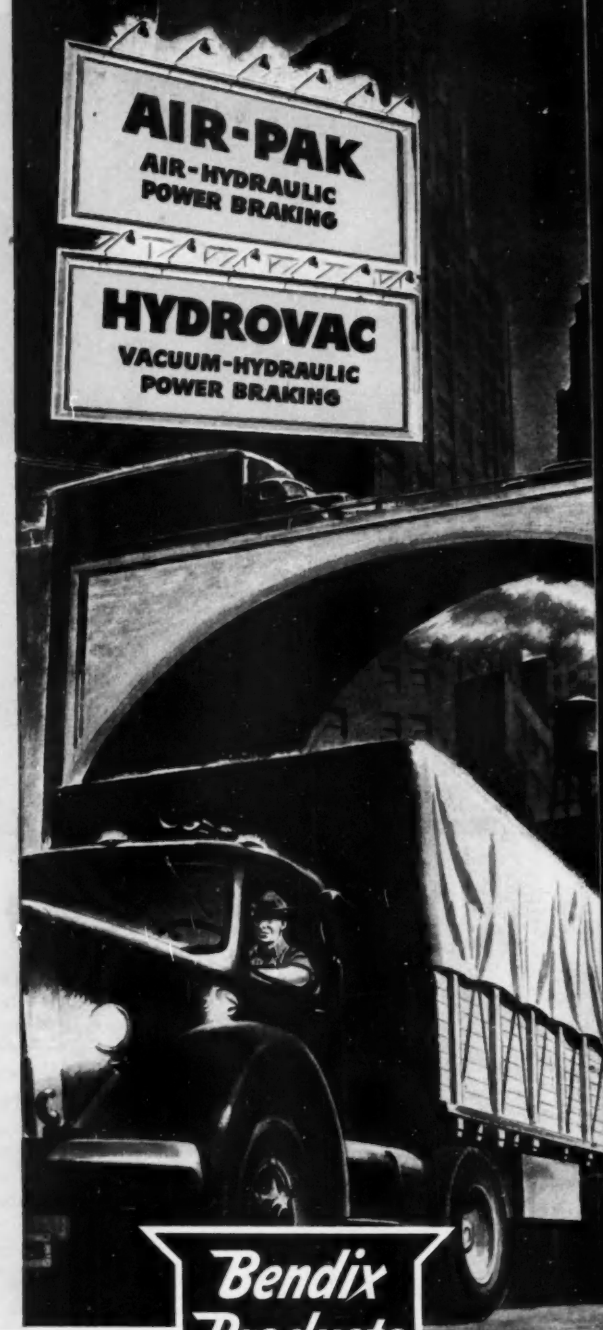


Air-Pak air-hydraulic power brake unit



Hydrovac vacuum-hydraulic power brake unit



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High Spots of This Issue

Balancing Engine and Torque Converter

Interesting description is here given of the Dynetric balancing machine installed in the Chrysler Division East Jefferson plant. The machine balances the complete engine assembly together with the torque converter. See page 32.

Automatic Materials Handling at Ford

Centering its discussion on the new parts plant of Ford Motor Co. in Monroe, Mich., this article illustrates again the high values accruing from the extensive employment of automation at Ford. You will want to turn to page 36.

Three SAE Meetings

At the recent National Transportation Meeting, National Diesel Engine Meeting, and National Fuels and Lubricants Meeting, held simultaneously in Chicago, 24 technical papers were presented. Here is given a resume of the meetings, and a lengthy sampling of the reports. Page 40.

Power Steering for Modern Vehicles—Part I

This first part of a two-part article discusses development of various types of power-assisted steering mechanisms, their features and advantages. See page 46.

Pontiac's Dual-Range Hydra-Matic

Included in its offerings for 1952 is Pontiac's new Dual-Range Hydra-Matic transmission providing choice of two high driving ranges at the option of the driver. Details, page 49.

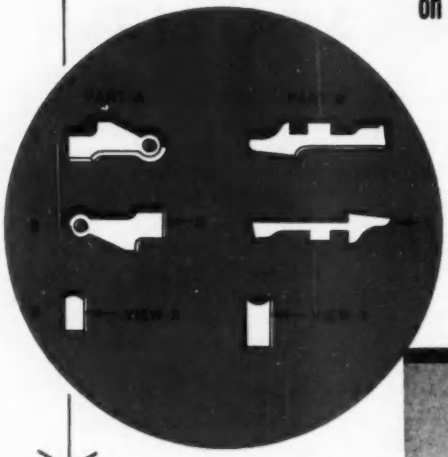
24 New Products Items And Other High Spots, Such As:

An automatic machine that produces strong economical spinnings; details of Buick's XP-300; how Chrysler is looking ahead; a new iron plating method disclosed by Van der Horst; an Italian "Jeep" in production; the influence of the Defense Program as discussed by body engineers; a conference on renegotiation held by New England executives; the Metals market; and news of the machinery industries.

News of the Automotive Industries, Page 17
For Complete Table of Contents, See Page 3

AUTOMOTIVE INDUSTRIES COVERS
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES • BODIES • TRAILERS • ROAD MACHINERY • FARM MACHINERY • PARTS AND COMPONENTS • ACCESSORIES • PRODUCTION EQUIPMENT • SERVICE EQUIPMENT • MAINTENANCE EQUIPMENT
ENGINEERING • PRODUCTION • MANAGEMENT

BROACHING TWO DIFFERENT PARTS
...THREE OPERATIONS EACH
on Cincinnati Duplex Vertical



Drawings of two parts broached on the All-Cincinnati equipment illustrated, showing sequence of operations and stock removal.

Part name	Gun parts
Material	Steel forging
Operation	Broach contour complete
Depth of cut	Variable—see drawings
Broaching speed	36 feet per minute
Production	53 per hour, each part
Machine	CINCINNATI No. 5-54 Duplex Vertical Hydro-Broach with complete tooling

Multiple operations on average quantities of small work can often be a stumbling block to production. How one stumbling block was removed by Cincinnati Application Engineers is illustrated here. Two small parts—call them A and B—were costing entirely too much to machine, so they were tooled up for *broaching* on a *Duplex Vertical*. The double ram machine, ordinarily a high production unit, was chosen so that part A could be broached by one ram, and part B by the other. A CINCINNATI No. 5-54 Duplex Vertical Hydro-Broach, illustrated here, two three-station fixtures, and suitable inserts (cutters) complete the equipment, ready for production. ¶ Fixtures are manually operated and the parts progress through three stations from the left- to the right-hand side. Production averages about 53 of each part per hour. ¶ Hydro-Broach features of value in producing work of this type include pre-set cycle control to safeguard the operator; hardened and ground ways, automatically lubricated for long life; clamp and dovetail positioning of broach holders to facilitate changing setups. ¶ Your low production work gets just as good treatment as big volumes at Cincinnati Milling, for we can weigh the advantages of milling and broaching, and offer you the lowest cost method. And if you're not familiar with the new CINCINNATI Duplex Vertical Hydro-Broach Machines with receding tables, write for literature.

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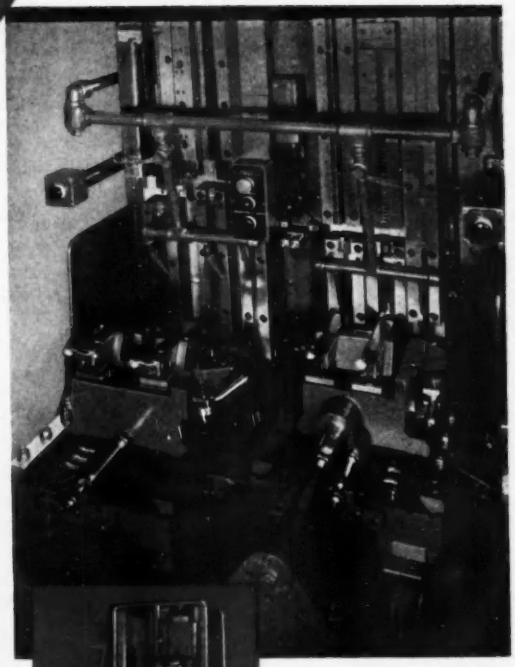
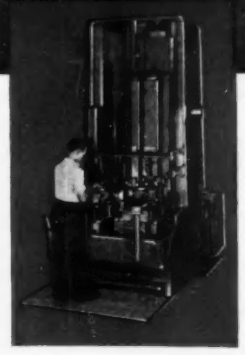




CINCINNATI Duplex Vertical Hydro-Broach. You may obtain complete specifications by writing for catalog No. M-1709-1.

News of the AUTOMOTIVE INDUSTRIES

Vol. 105, No. 11 December 1, 1951

De Soto Opens Up New Engine Plant

De Soto Div. of Chrysler Corp. recently took the wraps off its new plant for the production of the new De Soto V-8 engine which is scheduled to be introduced in a new De Soto car early in 1952. The installation of automatic machinery and materials handling equipment in the plant is reported to be so extensive as to eliminate almost entirely the need for hand labor. Nearly every moving operation is performed electrically, hydraulically, or mechanically.

Excellent quality control has been achieved throughout the plant with hundreds of gages, including the latest air types, checking each part carefully as it goes through each production step. Collection and disposal of waste metal from the machining operations is completely automatic.

The engine block is machined entirely on automatic transfer machinery. These machines, which average 84 ft in length, perform the milling, drilling, reaming, boring, topping, and all other necessary operations. Comparable machines are used on the intake manifold, bearing caps, cylinder head, and chain case cover. The plant is said to have a machining capacity of 60 engines per hour.

Occupying 328,229 sq ft adjoining the De Soto body plant in Dearborn, Mich., the new unit gives De Soto an integrated automobile manufacturing set-up with assembly plants in Detroit, Mich., and Los Angeles, Calif., new body and engine plants, and a press plant.

Canada Freezes Car And Truck Models

Following the recent U. S. lead, Canada has taken action to freeze its passenger cars and trucks on 1952 models. The step was taken for the same reason that was responsible for the U. S. ban on new models—a serious scarcity of machine tools. Incidentally, a joint U. S.-Canadian program has been launched to form a machine tool pool, and in this way Canada will receive a share of U. S. production.

K-F Discontinues Frazer Car Line

Confirmation by Kaiser-Frazer Corp. that production of the Frazer line has been discontinued did not come as any particular surprise to the industry, for emphasis upon the Frazer has been diminishing for more than a year. The company did not say that the suspension is a permanent one, but there is serious doubt in the industry that the Frazer name will be revived, if and when K-F again introduces a luxury line of automobiles. Even though production has been suspended, the Frazer is not an "orphan" in the usual sense, since mechanical specifications are identical with those of the Kaiser; thus, there is no question of availability of replacement parts for current owners.

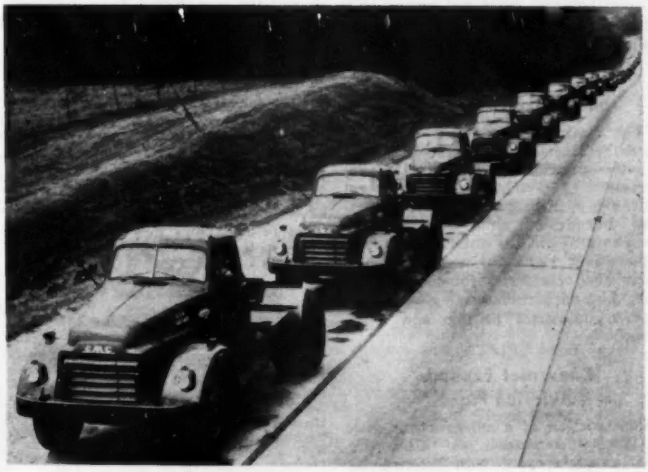
Studebaker Corp. Opens Eastern Assembly Plant

Studebaker Corp.'s $4 million Eastern Assembly Plant, New Brunswick, N. J., was formally opened recently. Built for the assembly of Studebaker automobiles for the eastern market, it will be used indefinitely for the manufacture of components and parts for J47-S23 turbo jet aircraft engines.

The plant, construction of which was started in July, 1950, is situated on a 165-acre tract of land. Its main building is 1320 ft by 320 ft with a minimum clearance inside of 18 ft in height. Constructed of steel with 40 ft by 40 ft bays, the main walls are of concrete block faced with brick while the floor is concrete. Total area of the plant is 425,000 sq ft.

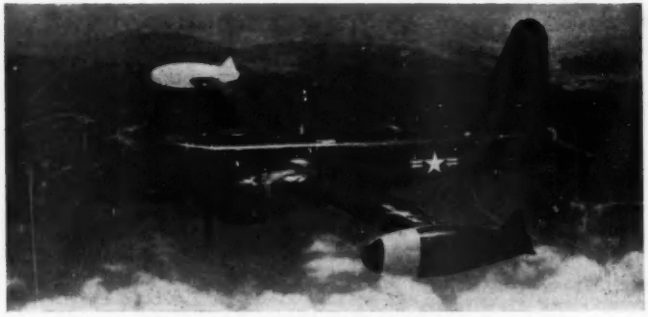
Chevrolet Increases Truck Prices 1.8%

Chevrolet Div. of General Motors Corp. has been granted OPS approval to increase truck prices 1.8 per cent to compensate for added costs of conversion steel used in production. Price increases range from about $18 on the one-half ton commercial chassis to approximately $35 on the two-ton truck with stake body.



ARMY ROLLS IN GMC TRUCKS

A long line of GMC Truck and Coach Div. Model 650, 150-hp Diesel highway tractors for U. S. Army test, driven by U. S. Army Transportation Corps personnel, leaves the factory at Pontiac, Mich., for Fort Eustis, Va.



DRUMS ALONG THE WINGTIPS

Center-mounted teardrop drums on Lockheed's P2V antisubmarine bomber carry fuel, radar, and searchlight. They are equipped with fins to give stability and steer them clear of the plane. Earlier types, installed by Lockheed on Shooting Star jet fighters, were hung beneath wing instead of being center-mounted.

Twin Coach Acquires Leyland Rights

Acquisition of exclusive American manufacturing and sales rights to the complete line of Leyland Diesel engines, produced by Leyland Motors, Ltd., has been announced by Twin Coach Co. These will be sold in the U. S. under the name of "Fageol-Leyland" and will be altered to incorporate SAE standard threads as well as all accessories and fittings. The engines, which have power ranges from 90 to 200 hp, will be installed in buses and trucks for U. S., Canadian, and export sale. In addition, a line of Fageol-Leyland industrial power units for use in power shovels, tractors, drill rigs, etc., will be offered.

NPA Cancels Priorities on Export Tools, Parts

The National Production Authority recently amended Order M-79, which provides priority assistance in the procurement of certain maintenance, repair, and operating supplies for export. The amendment removes five items from coverage of the order. These are: replacement parts for machine tools; parts and accessories for motor vehicles; specialized industrial gloves; and leather industrial belting and abrasives.

Chevrolet Expands Aviation Plant

Construction of a substructure or a $20,800,000 expansion at Chevrolet's aviation engine project in Tonawanda, N. Y., is being rushed. The new addition to the plant will encompass 373,000 sq ft.

NPA to Alter Quotas For Second Quarter

Despite the protests of all passenger car manufacturers except Willys-Overland, Nash, and Kaiser-Frazer, NPA is expected to put into effect at the beginning of the second quarter of next year its revised percentages of industry allotments for individual companies. The reshuffled percentages will give K-F, Nash, and Willys-Overland a larger share of the industry's total production than they now have in order to make allowance for new cars they have introduced since June, 1950. The cars are the Nash Rambler, the Henry J, and the new Willys Aero passenger car.

K-F would get the largest increase, stepping up from 1.55 per cent of the industry's total to 2.47 per cent. The Willys boost would be from one per cent to 1.21 per cent, and Nash would get 3.45 per cent, compared with 3.3 per cent at present. Although the new percentages have not been officially issued, NPA has indicated that it will go through with them as planned. The table below shows how the new percentages compare with those currently in effect and how many cars each company could build if allowable production is set at 1 million for the second quarter.

	Percentages		Units	
	2nd Quarter 1952	Present	2nd Quarter 1952	Present
G. M.	41.00	41.35	410,000	413,500
Chrysler	21.43	21.65	214,300	216,500
Ford	21.00	21.35	210,000	213,500
Studebaker	4.13	4.25	41,300	42,500
Nash	3.45	3.30	34,500	33,000
Hudson	2.93	2.95	29,300	29,500
Packard	2.09	2.15	20,900	21,500
K-F	2.47	1.55	24,700	15,500
Willys	1.21	1.00	12,100	10,000
Crosley	.21	.35	2,100	3,500
Checker	.08	.10	800	1,000
Total	100.00	100.00	1,000,000	1,000,000

Government Actions Affect Both New and Used Cars

Various actions by the Office of Price Stabilization and the National Production Authority recently exercise a considerable influence on future planning in the automobile industry. First, OPS rolled back ceiling prices on used automobiles six per cent below levels of last January. Although an exception will be made in the case of 1951 models, which may continue to be sold at current market prices, they, along with all others, will be subject to a two per cent deduction for depreciation beginning in January and for each quarter thereafter. Provisions of the regulation are effective Nov. 20, but the new prices do not go into effect until Dec. 20.

Second, in an order issued Nov. 20, OPS clarified its manufacturers' new passenger automobile ceiling price regulation (CPR, Rev. 1) by an amendment to permit manufacturers to include increases in the Federal excise tax in establishing ceiling prices for extra, special, or optional equipment.

Finally, NPA stated recently that automobile and truck makers will be allotted only enough regular steel plates to meet 60 per cent of their approved first-quarter 1952 production schedules. NPA went on to say that they would, in all probability, have to make up the other 40 per cent with premium-priced conversion steel.

Ford to Develop Modern Community

In accordance with its established community relations policy, Ford Motor Co. is putting into effect plans for developing about 4500 acres of land in Dearborn, Mich., into a model residential and commercial area. The contemplated development will have churches, schools, playgrounds, parks, stores, and other necessities of a modern and progressive community.

INDUSTRIES

Sears Roebuck to Sell K-F Built Automobile

The automobile industry is watching with a great deal of interest the agreement reached by Kaiser-Frazer Corp. with Sears-Roebuck and Co. under which the latter will market a new, low-priced K-F passenger car to be named the "Allstate." Actually, the car is not "new" in the usual sense of the word, since it will be essentially the Henry J with some modifications in appearance and perhaps a few other minor changes. Initially, the program will cover 17 Sears retail stores in the south and southwest areas of the U. S. Industry sources consider that the 17 cities will comprise a test area and that, if the venture proves successful, the car selling program may be extended to other sections of the country.

Neither specifications nor prices of the Allstate car, which will be introduced sometime before Christmas, were revealed by Sears or K-F. Production at the K-F plant is expected to start the first week in December, indicating that only minor changes will be instituted to differentiate the car from the Henry J. It is understood that the front end appearance will be different, but that no major tooling is involved for the change.

Two major problems confront Sears in the merchandising of passenger cars that do not apply to other forms of merchandise. One of these is the trade-in problem, and the other is service. It is reliably reported that Sears intends to establish a used car department, although at the outset it probably will wholesale its trade-ins until it can get the used car operation established. The company also plans to service the cars it sells in its own shops and other service establishments in its immediate area. This presumably would include local Kaiser-Frazer dealers, independent repair shops, and possibly service shops of competing makes. Sears also will handle a complete line of parts.

It is reported that the K-F dealer body has met the entry of Sears into the dealer group with mixed reactions. Some dealers are critical, seeing in the action a threat to their own future existence because of competition from Sears' merchandising techniques and traditional policy of low mark-up per unit. Others believe the advantages of getting a great many more Kaiser-made cars on the road will be beneficial to the whole organization. Edgar F. Kaiser, K-F president, has stated that the agreement with Sears will in no way change the company's established method of marketing the Kaiser and the Henry J through distributors and dealers.

TWIN-ENGINE SKY GIANT

This flight photo of Consolidated Vultee's Convair-Liner 340 twin-engine transport shows the 44-seat pressurized cabin. First production models of the 45,000-lb transport will be delivered early next year. More than 100 of the high-speed planes have been ordered by domestic and foreign airlines.

GM of Canada Plans New Winnipeg Plant

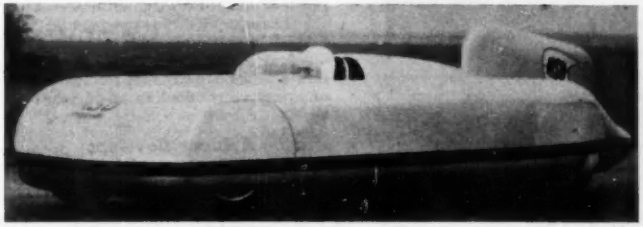
General Motors of Canada, Ltd., has acquired a 100-acre site at Winnipeg, Manitoba, where a new assembly plant and parts depot will be built. It is estimated that it will take three years to complete the $2.5 million structure.

Firestone Mass-Producing Aircraft Rocket Motors

The Firestone Tire & Rubber Co. has revealed that it is mass-producing rocket motors for aircraft rockets at its Akron, O., plant. Standardized for use by Navy or Air Force combat aircraft, the rockets are being produced under a contract with the U. S. Navy Bureau of Ordnance. Component parts of the rockets are: a five-in. steel tube, a multiple-nozzle exhaust ring, war head, launching brackets, and tailpiece fins. The speed of the rocket projectile is controlled by the precision-tooled nozzles, which restrict the discharge of propellant gases. Flight stability is provided by the fins to avoid deviation from the line of flight to the target.

Chrysler to Build Truck Engines at New Plant

Chrysler Corp. soon will go into production of truck and industrial engines at its new engine plant in Trenton, Mich., near Detroit. Although the plant is not yet completed, machinery is being moved into place, and production of engine parts will start soon. The operation includes manufacture of blocks, heads, pistons, crankshafts, and many other parts and final assembly. Four models of truck engines and two industrial engines will be built at the plant.



Acme

RECORD-SMASHING RACER

A 105-hp midget racing car, driven by Ferdi Lehder, streaks down the course in Frankfurt, Germany, during a recent competition. Two formerly British-held records were broken at speeds better than 200 mph.

Thermoid Buys Mead Stock

It was recently announced that Thermoid Co., automotive parts manufacturer, has acquired all the outstanding stock of Mead Aviation Equipment Co. The latter produces safety belts and parachutes for the Air Force. The purchase price was not revealed.

New Models May Come Despite Tool Curb

Since there is apparently nothing in the Government's recent order restricting machine tool order deliveries that would prohibit any automobile company from manufacturing its own machine tools, if it could do so and if it could get the necessary materials, there is some possibility that at least one company will follow that course. E. C. Dock, general sales manager of Dodge Div. of Chrysler Corp. said recently that Dodge may have to manufacture some of its production machinery. He did not elaborate on whether or not he was talking about machinery for production of the new overhead valve V-8 engine, for which tooling has been partially completed, but such might well be the case.

Other manufacturers whose engine programs may be upset by the order are Ford, Buick, and Pontiac. Tooling for the new V-8 overhead valve Lincoln engine and the Ford Six in-line overhead valve engine, as well as for the new De Soto overhead valve V-8, is either completed or so nearly finished that production of these engines will go on according to schedule and will be introduced early next year. Both Pontiac and Buick have V-8 engines in the works, but it is impossible now to determine when machinery will be available to permit their production.

Another interesting point is that the order does not cover die shops, so that the possibility of fairly new body changes next year is not ruled out. Whether or not the shops will have sufficient capacity available to work on automobile dies, however, is another question.

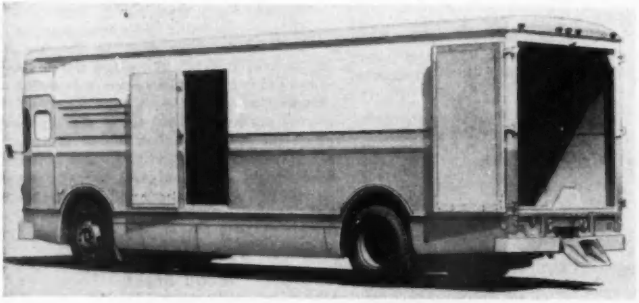
SUBURBAN COACH

The new ACF-Brill SU-37 coach has an overall length of 29 ft, 11 in., a height of nine ft, six and five-eighths in., and a wheelbase of 198 in. The 37-passenger vehicle weighs 13,400 lb and is powered by an International RD-450, six-cylinder, valve-in-head engine.

Aluminum Car Engine Seen As Production Reality

Judging by some private demonstrations in the development laboratories of the Aluminum Co. of America in Cleveland, O., the aluminum passenger car engine is now a production reality for advanced designs. Novel methods have been developed for making large parts, such as cylinder blocks and cylinder heads in section or wafers, which are then brazed together to make the most intricate parts. It is said that even the complex one-piece intake manifolding for the new V-8 engines can be made by this technique without resorting to the use of cores.

The process is intended exclusively for large volume production because of the initial cost of tooling and equipment. However, if component parts of engines are specifically designed to suit the requirements of the process, there is definite promise of lower overall cost through better control of quality and the elimination of considerable machining in the engine plant.



MANEUVERABLE DELIVERY TRUCK

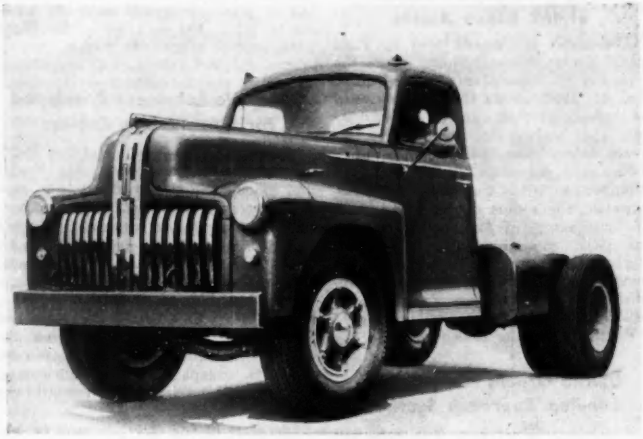
The Fageol Super Freighter "Manhattan Express" model, recently introduced by Twin Coach Co., has an overall length of 33 ft (other models available from 28 to 40 ft). Eight ft wide and 11 ft, six in. high, it contains 1710 cu ft of cargo space with a maximum payload capacity of 15,000 lb. Operated on gasoline or propane, the truck is recommended for use in congested areas. Diesel power is also available if desired.

Dual Exhaust System Cuts Power Loss

The current trend toward greater horsepower in passenger car engines has spurred considerable research on improvement of the exhaust system to cut down the power loss caused by back pressure. It is reliably reported that one 1952 model will have a dual exhaust system, one for each bank of the V-8 engine. In the development of the Chrysler K-310 experimental engine, it was found that providing individual ports for each cylinder and a straight-through exhaust for each bank of cylinders resulted in an increase of 25 hp.

Autocar Develops Light Tractor

The Autocar Co. has announced development of a light-weight, heavy-duty tractor with a gross hauling capacity of 50,000 lb. The new model, designated C-65-T, has the front axle set back of the engine to bear 5620 lb of the total 9390-lb chassis weight.



VERSATILE TRIO

The Federal Truck Co.'s new 3400 series consists of three models with a GVW range of 23,000 to 25,000 lb. The model shown has a 136 in. wheelbase, but others in the series have wheelbases ranging up to 250 in. This line is powered by Federal's Power-Chief six-cyl, valve-in-head engine which has a 371 cu in. displacement and develops 145 hp. Chassis features a swing lift fender design and wide-vision cab.

Chevrolet Gets Order For Tank Drives

Chevrolet Div. of General Motors Corp. has received the third defense contract for its Cleveland, O., manufacturing plant. The latest order is for production of final drive units for medium tanks. Production is already underway on front axles and pressed metal parts for 6 x 6 military trucks. The axles are used in trucks being built by GMC Truck and Coach Div. Other components made for the 6 x 6 military truck include rear axles, manufactured in Detroit plants, transfer cases made by Chevrolet, Toledo, O., and cabs built by the Chevrolet unit in Indianapolis, Ind.

For the past several months machine tools have been moved into the Cleveland operation in preparation for production of parts and subassemblies for two Wright R-3350 aviation engines which Chevrolet will assemble in Tonawanda, N. Y. The division reports that machine tools built for other purposes are steadily being converted to defense work at the Cleveland plant. The tank final drive job is now in the pilot production stage.

Kearney & Trecker Seeks Subcontracting Firms

In order to comply with a government request that machine tool builders increase the industry's capacity through subcontracting, Kearney and Trecker Corp. is actively negotiating agreements with several other firms to produce complete machines as well as subassemblies and parts. Currently only about 5 per cent of the company's shipments are produced by subcontracting firms, but this figure is expected to increase to 40 per cent by the summer of 1952 and to approximately one half of its total shipments by the end of next year.

Scintilla Magneto Expands Further

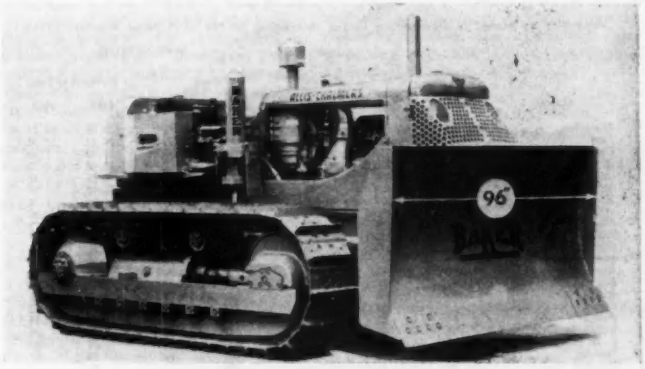
Bendix Aviation Corp.'s Scintilla Magneto Div. is building its second factory addition in recent months. Construction has started on a new brick and steel building with an area of 14,400 sq ft. The new unit will house the Ceramics Dept., a ceramics laboratory, and other facilities.

Plymouth Completes First Plane Hull

Plymouth Div. of Chrysler Corp. completed the first 60-ft hull for the Grumman Albatross plane at the Plymouth plant in Evansville, Ind., recently. Previously, the plant had completed and shipped several hull subassemblies to the Grumman plant at Bethpage, L. I. About 200,000 sq ft of the half-million sq ft plant at Evansville is devoted to production of the plane hulls. The area devoted to aircraft work formerly was used for assembly of station wagon bodies, an operation which has been moved to the Briggs plant at Evansville. The remaining 300,000 sq ft of space continues to be used for the production of automobiles.

Marmon-Herrington Awarded Contract

The Marmon-Herrington Co. has announced the award of a contract by the U. S. Air Force in excess of $10 million for the production of several hundred fire-fighting crash trucks. The new trucks, designated as Model 0-10, are designed for all-weather use.



TRANSPORTABLE BULLDOZER

The Baker Manufacturing Co.'s new 9-X bulldozer mounts on a standard nine-ton, 70-drawbar hp Allis-Chalmers crawler tractor. It is 96 in. wide, weighs approximately 3400 lb, and can be transported over highways at any time without permits, according to the manufacturer.

News of the AUTOMOTIVE

Annual Wage to Be Issue In Steel Negotiations

The automobile industry is anxiously watching progress of negotiations between the CIO steel workers' union and steel companies for several reasons. The principal cause for concern is, of course, whether or not there will be a steel strike to enforce union demands. Many observers feel that the Government would intervene in the event of a strike and employ the Taft-Hartley Act to keep workers on the job and production going while government mediators took over.

Another important point in the negotiations is the demand by the steel workers for a guaranteed annual wage, a goal very dear to the hearts of union leaders in the automobile industry. It also is a foregone conclusion that the union will demand wage increases considerably in excess of the approximately $ .05 an hour increase permitted under the Wage Stabilization Act. It still is too early to determine what the outcome of negotiations will be, but a wage increase, with subsequently higher steel prices, is almost certain.

Orenda Engine to Have An Afterburner

According to a recent announcement, the Canadian Orenda jet engine is to be fitted with an afterburner to provide extra combat speed. The engine is being made by Avro Canada, Ltd., for the CF-100 fighter plane.

Ford 1950 Report Shows $1.469 Billion Assets

A delayed tax report filed by Ford Motor Co. in Massachusetts where the company is incorporated, and dated Dec. 31, 1950, shows that the company had assets at that date of $1,469,019,000, the highest in its history. As usual, there is no indication of Ford's dollar sales, earnings, or dividends. In comparison with the previous year, however, the report shows an increase of total assets of $125,742,000 during the year, compared with a gain of slightly more than $194 million for the preceding 12 months. Earnings retained in the business increased to $623,769,000, against a similar item of $464,412,000 in the 1949 report.

United Orders More Bendix Landing Approach Systems

According to a recent announcement by Eclipse-Pioneer Div. of Bendix Aviation Corp., 64 United Air Lines "Mainliners" will be equipped with the "flight path control" automatic landing approach system which it is building. Designed to facilitate landing under bad weather conditions, the system is said to orient a plane automatically between two radio beams projected from an airport and enable it to be guided down to the runway with ease.

Bendix's PB-10 automatic pilot, with which the flight path control system is designed to operate, is now installed or specified for 343 planes operated by 24 domestic and foreign airlines, company officials report. Out of the total number of planes equipped with the automatic pilot, 105 will have the flight path control system as well.

Synthetic Lubricant Developed for Gas Turbine Engines

According to a recent Defense Dept. announcement, the Navy, Air Force, and industry have joined hands to produce the first joint military specification for a synthetic lubricating oil for gas turbine aircraft engines. The new oil is said to be applicable for use in both turbo-jet and turbo-prop engines and will withstand operating temperatures from —65F to 500 F. It is not intended for reciprocating engine use and is not expected to replace petroleum products, except where its lubricating characteristics are required for military needs.

The base of the new lubricant is reported to be one of a class of chemicals known as aliphatic diesters. Phenothiazine is added to the base in order to prevent oxidation at high temperatures. A third chemical, tricresyl phosphate, is said to aid in the prevention of gear wear. Contemplated production figures for the new lubricant are classified.

Work Stoppages Cut Hudson Motor Net

The prolonged labor dispute, which resulted in practically daily shutdowns of Hudson Motor Car Co. operations over a period of several weeks, is reflected in the company's earnings statement for the first nine months of this year. Net profit for the period amounted to only $967,379, or a drop of nearly 90 per cent below the same period of 1950, when earnings were $9,282,184. As a result of the labor dispute, the UAW-CIO has filed a suit for $500,000 damages for loss of workers' wages and union dues. Hudson, on the other hand, has filed a countersuit for $1.5 million damages, charging that slow-down tactics by final assembly workers resulted in losses of that total.

Lockheed Subsidiary Sold Outright

Aerol Co., Inc., a subsidiary of Lockheed Aircraft Corp., has been sold to a group of prominent businessmen. The firm's production of casters, wheels, and materials-handling equipment will be continued, and the new management will investigate the possibilities for expansion and the development of new aluminum products.

1951 NEW TRUCK REGISTRATIONS*

Arranged by Makes in Descending Order According to the 1951 Nine Months' Totals.

MAKE	September 1951	August 1951	September 1950	NINE MONTHS Units 1951	Units 1950	Per Cent of Total 1951	Per Cent of Total 1950
Chevrolet	28,342	32,423	40,134	275,099	318,878	35.61	36.75
Ford	21,954	21,824	31,045	192,083	238,710	24.87	27.51
Dodge	8,653	8,710	10,821	81,021	69,308	10.49	7.99
G. M. C.	8,912	8,765	9,249	77,711	72,088	10.06	8.31
International	8,906	8,096	11,369	70,250	81,197	9.09	9.36
Studebaker	3,067	2,923	4,253	24,124	36,986	3.12	4.22
Willys Truck	1,302	1,074	1,749	11,522	11,393	1.49	1.31
White	845	883	1,243	9,456	8,420	1.22	.97
Mack	890	894	775	7,687	6,826	1.00	.79
Willys Jeep	785	855	895	6,689	6,491	.87	.75
Diamond T	312	373	535	3,577	4,253	.46	.49
Divco	251	342	438	2,994	3,034	.39	.35
Reo	230	243	440	2,721	2,635	.35	.30
Brockway	129	161	195	1,758	1,599	.23	.18
Autocar	116	153	149	1,601	1,523	.21	.17
Federal	50	58	93	794	1,026	.10	.12
Pontiac	84	95	63	641	1,201	.08	.14
Kenworth	51	45	82	517	457	.07	.05
F. W. D.	27	37	17	352	225	.05	.03
Sterling	20	26	34	267	261	.03	.03
Peterbilt	20	21		230		.03	
Misc. Domestic	166	114	181	1,166	1,377	.15	.16
Misc. Foreign	24	31	34	194	287	.03	.03
Total—All Makes	84,814	87,646	113,784	772,456	867,765	100.00	100.00

* Based on data from R. L. Polk & Co.

INDUSTRIES

1951 To Be Second Best Vehicle Year

Despite Government imposed curtailment on production of automobiles in the third and fourth quarters of this year, the industry will wind up 1951 with the second best year on record for both passenger cars and trucks. That was assured during the third week in November, when industry production passed the 6,249,988 unit mark established in 1949. Of course, truck production played a large part, since it was running 195,000 units ahead of last year, and will set an all-time record this year. However, passenger cars were only 235,234 units behind the total for 1949 and will probably surpass that year's production by at least 75,000 units.

Meanwhile, the outlook for 1952 remains uncertain. It generally is conceded that about 4 million cars will be permitted, but there are various differences of opinion as to whether production will be something under that or possibly considerably more. There is some evidence that sheet steel is not quite as tight as it was formerly and that conversion steel programs are on the way out for most companies.

On the other hand, alloy steel is very tight and copper is even worse. A great deal of work has been done and is continuing on finding substitutes for scarce copper, and the ingenuity of the industry is expected to be called into play to keep pace with the continuing shortage.

While many officials in the automobile industry think that a car shortage is certain to develop next year, there are others who believe that unless demand picks up sharply from what it is at present, the market will absorb only about as many cars as are being produced currently. They agree that the proposed production rate next year normally would not be enough to meet the needs of new car buyers, but they think that higher prices caused by the increase in excise taxes and further upward price adjustments may drive many buyers out of the market.

On the other hand, sales still continue to exceed production, and dealer inventories for the industry as a whole are dropping. If that trend continues, a shortage is bound to develop sooner or later, a fact which in itself probably will stimulate some scare buying.

Brookings Report Backs Essentiality of Cars

An impartial report from Brookings Institution supports the automobile industry's claims of the essentiality of the passenger car. The survey states that while no specified level of production could be defended as essential, the current 4 million annual car production rate is the desirable minimum. It also recalls that the importance of passenger cars was underestimated at the beginning of World War II, so that there was a severe car shortage for several years after the war.

1951 NEW PASSENGER CAR REGISTRATIONS*

Arranged by Makes in Descending Order According to the 1951 Nine Months' Totals.

MAKE	September 1951	August 1951	September 1950	NINE MONTHS Units 1951	Units 1950	Per Cent of Total 1951	Per Cent of Total 1950
Chevrolet	79,593	94,627	137,662	855,762	1,090,051	21.15	22.74
Ford	62,099	72,897	110,211	688,878	897,843	17.03	18.90
Plymouth	46,387	51,042	73,034	449,662	364,653	11.14	7.68
Buick	30,623	30,139	80,180	312,558	405,143	7.73	8.53
Pontiac	27,998	27,506	41,654	287,570	336,270	6.61	7.08
Dodge	26,402	26,744	37,403	237,437	212,473	5.87	4.47
Oldsmobile	22,148	21,467	34,135	218,792	281,358	5.41	5.92
Mercury	17,963	19,956	26,030	184,346	242,888	4.56	5.11
Studebaker	20,076	20,008	25,701	161,322	223,023	3.99	4.70
Chrysler	11,882	11,525	16,665	122,407	102,885	3.03	2.17
Nash	14,031	13,172	9,722	105,974	137,719	2.62	2.90
De Soto	10,340	9,565	12,492	87,890	77,483	2.17	1.63
Hudson	6,680	7,095	9,859	78,247	113,904	1.93	2.40
Cadillac	7,090	8,350	12,394	75,026	72,800	1.85	1.53
Packard	5,568	5,126	3,515	52,390	52,330	1.30	1.10
Kaiser	3,743	3,960	13,286	42,640	66,566	1.05	1.38
Henry J	3,636	3,948		42,276		1.04	
Willys	2,177	2,166	3,376	20,897	27,429	.52	.58
Lincoln	2,402	2,324	2,953	20,148	29,819	.50	.66
Crosley	421	476	624	4,358	5,431	.11	.11
Frazer			476		11,200		.24
British Austin	385	268	427	2,822	4,533	.06	.10
British Ford	382	378	289	2,527	1,273	.05	.03
Miscl. Domestic	324	378	419	1,946	1,228	.04	.02
Miscl. Foreign	1,303	1,309	1,281	9,867	6,203	.24	.13
Total—All Makes	406,217	424,422	625,756	4,045,568	4,749,813	100.00	100.00

* Based on data from R. L. Polk & Co.

DOD Helps Contractors Find Supplier Firms

The Detroit Ordnance District has set up a special office in Detroit to bring together prime contractors and small firms seeking subcontracting work. The survey is designed for contractors in the lower peninsula of Michigan. Prime contractors have available at the office source files containing listings of and information on potential subcontractors. Small business firms seeking defense assignments are listed with the small business office at DOD, and any who have not yet done so are urged to submit their names to the office at 574 E. Woodbridge, Detroit 31, Mich.

Navy to Release Machine Tools

The Navy has announced that unused items in its reserve stocks of machine tools will be placed in service to expedite the armament program. According to reports, about 10,000 tools out of a former stock of approximately 47,000 are awaiting use. Defense contract holders should apply for lease of the tools directly to Government agencies letting the contracts.

Sept. Car Sales Exceed Production Figures

Predictions of an impending car shortage appear to be borne out by a comparison of registration and production figures for Sept. Although new car registrations of 406,217 were the lowest since Jan., 1950, they still exceeded production for Sept. by more than 40,000. Factory sales for the month, according to The Automobile Manufacturers Association, were 365,906. When the 15,660 cars exported are deducted, leaving a total of 350,246 for the domestic market, the excess of sales over new cars available to the public amounted to about 56,000 units.

McCord Corp. Expands Radiator Business

In its annual report to stockholders recently, The McCord Corp. revealed that it has radiator orders for part of Mercury and part of Ford truck requirements, in addition to its previous role as supplier for the Lincoln car. Ford also has adopted and will produce the McCord CT-type radiator core in its own manufacturing operations for a considerable part of its production.

The company also has obtained a radiator contract for the Nash Rambler, has increased its business with International Harvester Co., and has added several other customers for radiators, principally in the industrial and tractor department. Military production includes Army helmets, rocket motors for the Navy, and link ejector chutes.

News of the AUTOMOTIVE INDUSTRIES

Magnesium Association Holds Seventh Annual Meeting

The seventh annual meeting of the Magnesium Association, held in New York City, Nov. 15 and 16, attracted an attendance of over 250. Industry representatives and visitors sat in on an informative series of technical sessions on the problems confronting the industry and witnessed a display of exhibits of magnesium products (die castings, extrusions, forgings, deep-drawn parts, ladders, Army equipment, spinnings, automobile and aircraft parts, etc.).

At an opening press conference, Dr. J. D. Hanawalt, manager, Magnesium Dept., Dow Chemical Co., reported that monthly shipments of magnesium have doubled during the past 12 months and are now almost triple the pre-Korean rate. However, he pointed out that while magnesium production had increased to a point sufficient to meet current military needs, there is not nearly enough to fulfill civilian demands, particularly as far as thin magnesium sheet is concerned. By way of an interesting sidelight, he mentioned that although production of magnesium castings has again come to exceed that of wrought products, there was a trend in the other direction shortly before the Korean war broke out.

Wiser Brown, chief industrial engineer, Aluminum Co. of America, discussed his firm's use of magnesium from a fabricator's point of view in aircraft and aluminum alloy applications, while Howard Perkins, president, Brooks & Perkins, Inc., the next speaker, stressed the fact that his company (whose production has been entirely military for the past four years) has been able to reduce prices of magnesium products through improved techniques, in spite of higher operating costs.

Edward S. Christiansen, president, Magnesium Co. of America, commented that at the present time about 70 per cent of his firm's production is going for military uses, whereas before the Korean war it was 100 per cent civilian. He added that, due to its many advantageous qualities, magnesium has become a replacement, rather than a substitute, for many other materials. A. L. Rustay, chief metallurgist, Wyman-Gordon Co. followed with a discussion of forging press facilities being built by the Air Force. He stated that one press, for example, will have a capacity of 50,000 tons.

The formal program on the first day of the meeting opened with a session of the Castings Div. The following informative talks, presided over by A. J. Marotta, Utica Radiator Corp., were given: "Magnesium Casting Alloys Containing Rare Earths" (J. C. McDonald, Dow Chemical Co.); "Discussion of AZ91 Alloy" (R. T. Wood, Aluminum Co. of America); "Inspection and Salvage of Magnesium Castings" (B. G. Harr, Dow Chemical Co., Horace C. Cook, Aluminum Co. of America, and Arthur T. Ruppe, Bendix Aviation Corp.) The afternoon session, of which H. G. Warrington, Dominion Magnesium, Ltd., was chairman, heard Chester J. Orciuch, Wyman-Gordon Co., discuss "Magnesium Forgings," while R. Smallman-Tew, A. V. Roe, Ltd., reviewed "The Use of Magnesium in Canadian Aircraft."

Opening the second day's morning session, presided over by J. S. Kirkpatrick, Brooks & Perkins, Inc., was a talk by T. L. Patton, Dow Chemical Co., on "Impact Extrusion of Magnesium." Harold Robinson, Air Reduction Co., followed with an explanation of "Welding Magnesium by the Aircomatic Process." D. A. Tooley, Consolidated Vultee Aircraft Corp., concluded with an analysis of "B-36 Service Experience with Magnesium."

A thought-provoking discussion of "The Magnesium Supply Situation" by P. D. Helser, chief, Magnesium and Titanium Branch, Aluminum and Magnesium Div., National Production Authority, was the highlight of the closing session. Mr. Helser pointed out that an estimated total production of both primary and secondary magnesium for 1951 of 97 million lb, while considerably below the peak of 390 million lb produced during the peak year of World War II, is, nonetheless, an increase of 125 per cent over the 43,400,000 lb produced during 1950. He predicted that production of both types of magnesium in 1952 would reach a total of about 220 million lb, but even this total, while probably sufficient to meet defense and stockpile needs, will not be adequate to fulfill civilian demands.

After the formal meeting had adjourned, Association members named officers and directors for the coming year. A. W. Winston, Dow Chemical Co., was re-elected president; Howard Perkins, Brooks & Perkins, Inc., was named vice president; Otis E. Grant, Superior Bearing Bronze Co., was re-elected vice president; and Martha I. Hansen was again chosen assistant secretary.

Briggs Gets Large Defense Contract

Briggs Manufacturing Co. has been assigned a new multi-million dollar defense contract by Boeing Airplane Co. to produce large fuselage sections for the B-47B Air Force medium bomber. Briggs will start assembly of deck and wheel assemblies sometime in Dec. at a new plant now under construction in Detroit. Previous Briggs contracts call for production of airframe assemblies for heavy bombers and cargo planes.

(*Turn to page 58, please*)

REGIONAL SALES OF NEW PASSENGER CARS

Zone	Region	September 1951	August 1951	September 1950	Nine Months 1951	Nine Months 1950	Per Cent Change: September over August	Per Cent Change: Sept. over Sept. 1950	Per Cent Change: Nine Months 1951 over 1950
1	New England	21,440	24,585	32,530	231,826	266,909	−12.79	−34.09	−13.01
2	Middle Atlantic	76,978	89,092	109,687	778,979	889,441	−13.59	−29.94	−12.41
3	South Atlantic	48,790	48,904	67,340	476,742	556,875	− 0.23	−27.56	−14.38
4	East North Central	101,576	102,159	154,227	1,042,687	1,170,572	− 0.57	−34.13	−10.92
5	East South Central	19,072	20,046	25,382	187,375	238,937	− 4.85	−24.86	−21.49
6	West North Central	44,540	41,040	69,463	419,383	496,068	+ 8.52	−35.89	−15.61
7	West South Central	36,109	38,892	63,588	354,871	452,263	− 7.00	−43.11	−21.52
8	Mountain	14,247	14,887	19,736	136,430	167,986	− 4.29	−27.81	−18.80
9	Pacific	43,405	44,817	83,002	417,296	510,040	− 3.15	−48.06	−18.18
	Total—United States	406,217	424,422	625,755	4,045,558	4,749,613	− 4.29	−35.09	−14.82

States comprising the various regions are:—Zone 1: Conn., Me., Mass., N. H., R. I., Vt.—Zone 2: N. J., N. Y., Pa.—Zone 3: Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va.—Zone 4: Ill., Ind., Mich., Ohio, Wisc.—Zone 5: Ala., Ky., Miss., Tenn.—Zone 6: Iowa, Kan., Minn., Mo., N. D., S. D.—Zone 7: Ark., La., Okla., Tex.—Zone 8: Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo.—Zone 9: Cal., Ore., Wash.

Men in the News

Current Personnel Appointments and Changes at Plants of Automotive Manufacturers and Their Suppliers

Mack Motor Truck Corp.—**F. W. Beardslee** has been appointed assistant general manager of the export division.

Marquardt Aircraft Co.—The appointment of **Gardner Carr** as assistant to the president has been announced.

General Motors Corp.—**E. C. Klotzburger** has been named manager of the firm's new dual purpose plant at Arlington, Tex.

Miller Electric Manufacturing Co.—**R. A. Metcalf** has been promoted to sales manager.

E. I. du Pont de Nemours & Co., Inc., —**Duncan B. Cramer** has been named general sales supervisor over automotive and household specialties in the Specialties Sales Section of the Fabrics and Finishes Dept. **L. Gordon Medaris** has been appointed West Coast sales supervisor.

Chrysler Corp., Airtemp Div.—**J. F. Knoff** has been advanced to general sales manager, and **T. B. Hollencamp** has been named national service manager.

Young Spring & Wire Corp.—**Peter J. Gallette** has been appointed general sales manager of the firm. **William A. Clark** has been selected as manager of sales engineering in the Cushion Spring Div.

Benchmaster Manufacturing Co. — **Milton K. Grey** has returned to the company as general manager.

H. K. Porter Co., Inc., Quaker Rubber Corp. Div.—The appointment of **H. F. Robertson** as comptroller has been announced.

Carter Carburetor Corp.—**James T. W. Moseley** has been named chief engineer, and **Leland B. Read** has been chosen as his assistant.

Curtiss-Wright Corp. — **Ronald S. Gall** has been promoted to manager of public relations.

Borg-Warner Corp., Detroit Gear Div.—**A. J. McAllister** has been appointed president and general manager.

General Motors Corp., Pontiac Motor Div.—**Charles K. Delsig** has been named assistant parts sales manager.

Bogue Electric Manufacturing Co.—The appointment of **Leo G. Sands** as general sales manager has been announced.

Westinghouse Electric Corp.—L. E. Osborne has been named to the newly created post of executive vice president for defense products.

Nash-Kelvinator Corp., Nash Motors Div.—E. B. Brogan has been appointed media manager.

Charles H. Besly & Co., Machine Tool Div. —Roger A. Kenman has been named sales manager.

Heppenstall Co.—**Harry O. Lang** has been appointed vice president in charge of sales, succeeding **John P. Roche,** who has been promoted to executive vice president.

Goodyear Tire and Rubber Co.—**Loren A. Murphy** has been appointed assistant to **T. A. Knowles,** vice president and general manager of Goodyear Aircraft Corp.

Hunter Spring Co.—**Frank A. Votta, Jr.,** has been appointed chief engineer.

Bendix Aviation Corp., Scintilla Magneto Div.—**A. W. DeChard** has been named to head the aircraft sales department. **W. A. Uline** will manage industrial sales.

Packard Motor Car Co.—**Clare E. Briggs** has been appointed general sales manager. **Ray Abernathy** succeeds him as assistant sales manager.

Sealed Power Corp.—**Edwin C. Beck** has been promoted to chief engineer.

Warner Electric Brake & Clutch Co. —**Paul Harter** has been named chief project engineer of the industrial div.

Air Associates, Inc., Aircraft Products Div.—**Price Phelps** has been promoted to assistant sales manager.

Allis-Chalmers Manufacturing Co.—**R. M. Casper** has been selected to head the newly organized Power Dept.

Gabriel Co.—**Dr. Lan Jen Chu** has been named director of research.

Mechanical Handling Systems, Inc., Pre-Engineered Div.—The appointment of **S. C. Lloyd** as sales manager has been announced.

Eicor, Inc.—**Gordon Hirsch** has been chosen as contract administrator on all government rotary sales.

Nash-Kelvinator Corp., Nash Motors Div.—**R. E. Williams** has been appointed assistant sales training manager.

Ray-O-Vac Co.—**W. L. Bender** has been appointed merchandising manager.

Seiberling Rubber Co.—**E. F. Gates** has been promoted to manager of accessories and repair materials sales. He succeeds **O. K. Feikert** who will continue as manager of the service dept.

Morse Chain Co.—**Louis P. Smith** has been chosen manager of the company's plant in **Ithaca, N. Y.**

Federal Motor Truck Co. — **J. D. Porter** has been appointed works manager.

Necrology

Edward E. O'Neill, 58, former president of the American-La-France-Foamite Corp., died Nov. 11, in Elmira, N. Y.

Carroll B. Vickers, 56, well-known automobile and aircraft inventor, died Nov. 7, in Buffalo, N. Y.

Charles H. Stewart, president of the New Jersey Automobile Club, died Nov. 11, in Irvington, N. J.

Leon R. Ludwig, 47, director of engineering and research, Atomic Power Div., Westinghouse Electric Corp., died Nov. 14, in Pittsburgh, Pa.

let's take a **CLOSER LOOK** at

Fabrication Requirements

If you make hollow parts the economical way—from tubing—chances are you have one or more fabricating problems. This typical array of parts illustrates the wide range in severity of working that is involved in such operations as spinning, swaging, expanding, upsetting, bending, and forming. A corresponding diversity exists in the type, grade, finish, and mill condition of seamless and welded steel tubing used for their manufacture.

Remember, tubing is more than bar stock with a hole in it. It is a semi-finished product. B&W's ability to match its tubing to a myriad of end uses may enable you to make a better product . . . easier. Ask Mr. Tubes—your B&W Tube Company Representative—for help in selecting the tubing that is best for *your* fabricating requirements. Request a copy of Bulletin TB-324. TA-1641-M

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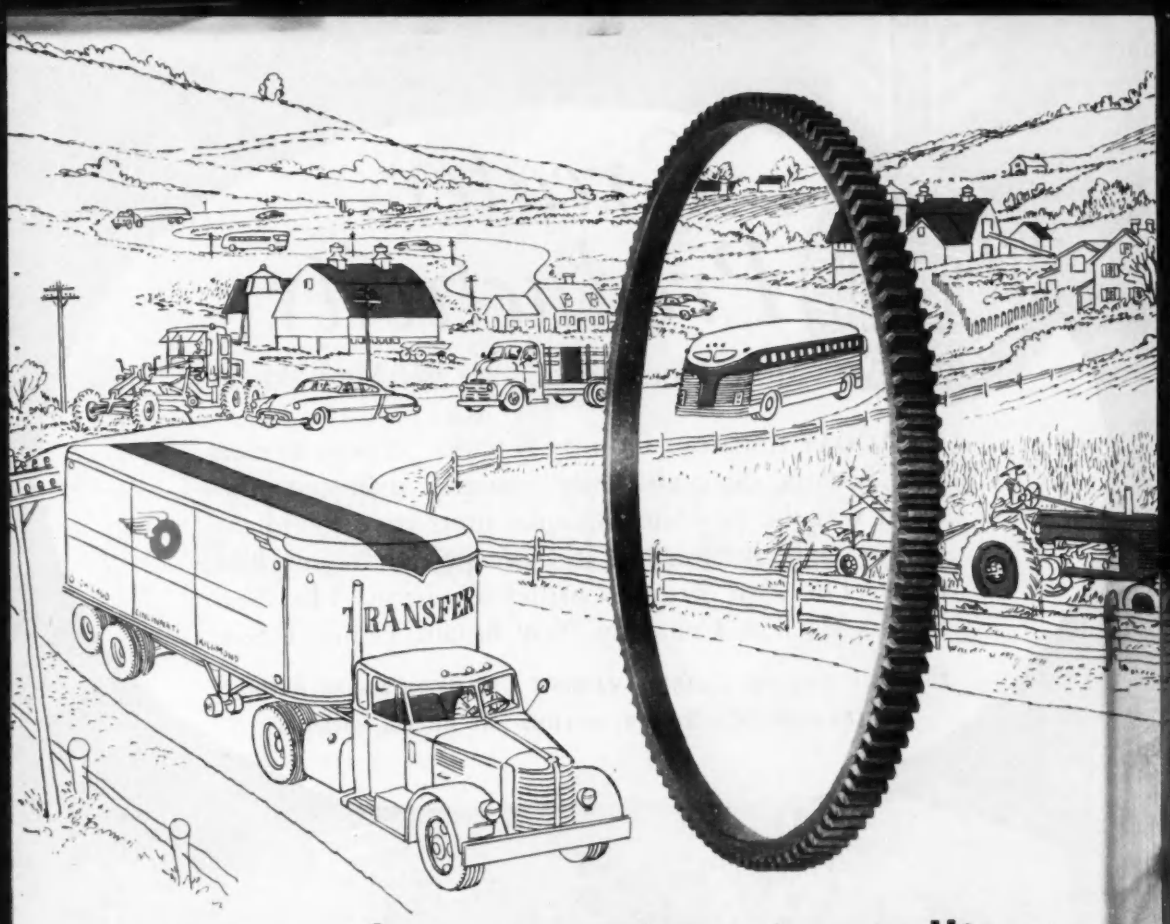

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Building flywheel ring gears that dependably *start* a multitude of engines is a part of our gear-making responsibilities. In vehicles of practically every type—trucks, buses, passenger cars, road machinery, farm equipment, whether gasoline or Diesel powered—"Double Diamond" flywheel ring gears help *start* the wheels that keep America rolling.

IMPORTANT NOTICE TO PRESENT AND FUTURE CUSTOMERS

During the present abnormal period Automotive Gear Works believes its first loyalties are due its present customers, many of whom are directly or indirectly in defense work. For that reason, every effort will be made to first satisfy the growing requirements of those companies who are already users of "Double Diamond" Gears. Where facilities or materials permit, the requirements of prospective customers will receive careful attention, and technical assistance will continue to be made available for the solution of gear problems regardless of whether or not we are now in a position to build the gears recommended.

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TODAY American Industry is under pressure to meet fantastic demands. Only yesterday, intense competition was the problem. Manufacturers have found the answer to both situations in more productive machine tools. The New Britain-Gridley Division, The New Britain Machine Company, New Britain, Conn., U.S.A.

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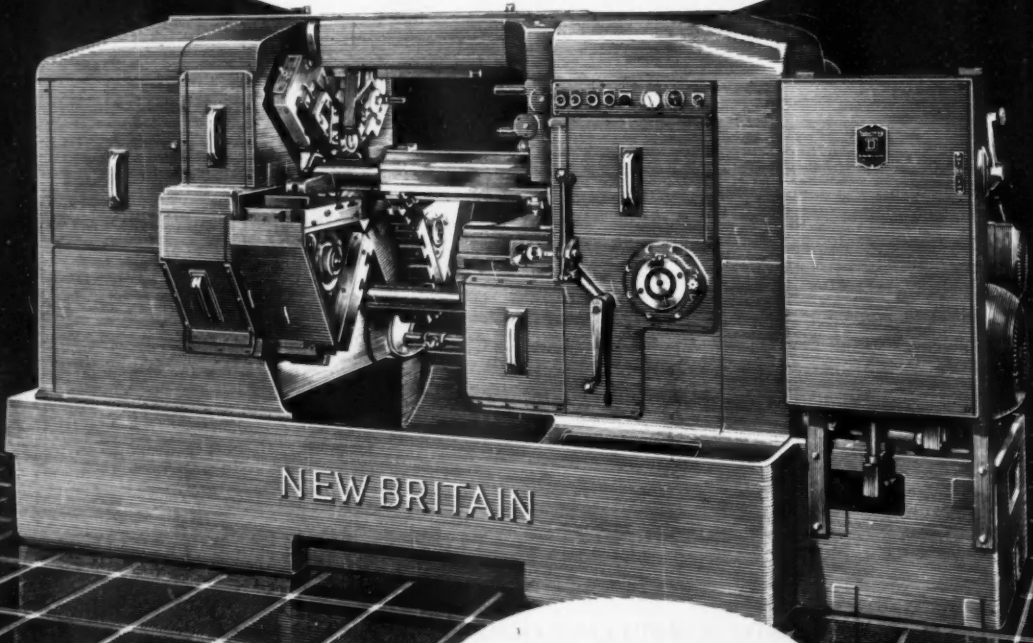

NEW BRITAIN

Automatics

THE WELSH TERRIER is one of the oldest terrier breeds, originally used in hunting foxes and badgers. Today he is prized as a good-natured playmate for children. Height, 15 inches; weight, 20 pounds. The hard dense coat is black and tan.

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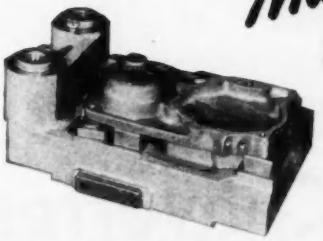
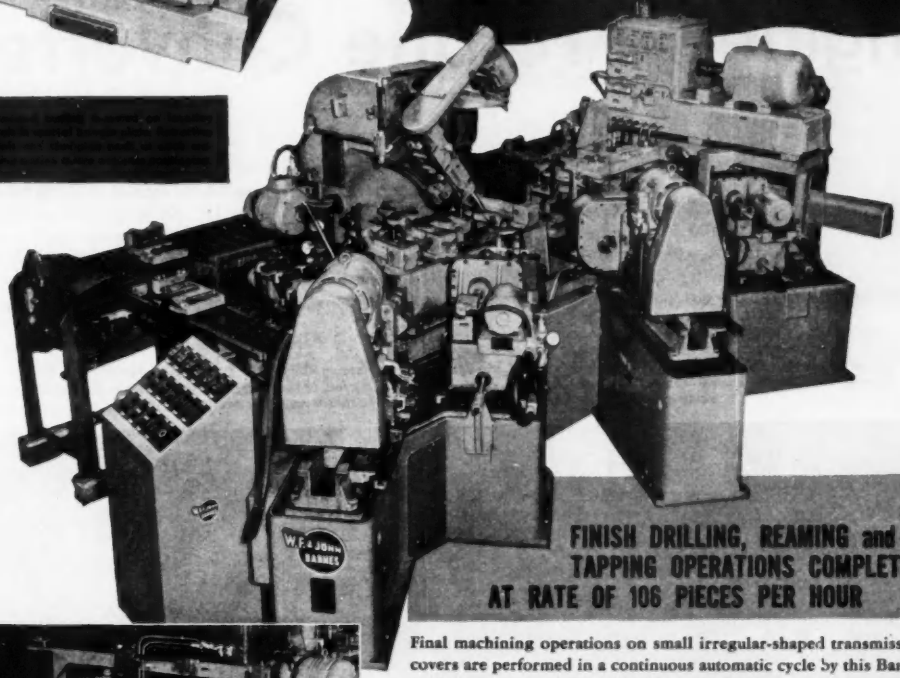
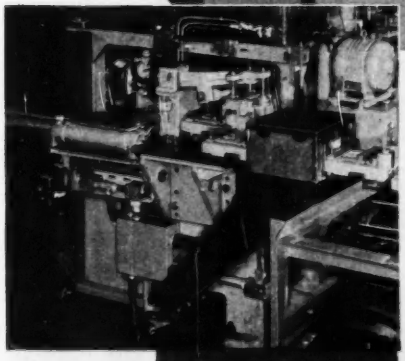
BARNES PROGRESS-THRU MACHINE...





FINISH DRILLING, REAMING and TAPPING OPERATIONS COMPLETED AT RATE OF 106 PIECES PER HOUR



Final machining operations on small irregular-shaped transmission covers are performed in a continuous automatic cycle by this Barnes 14-Station Progress-Thru Machine. Six drilling, one reaming, and two lead-screw tapping operations are completed at a rate of 106 pieces per hour. In addition, both loading and unloading operations are handled at the first station during the machining cycle.

Workpieces are fed through the machine on special transfer plates and are accurately clamped and positioned to insure precise machining results. After machining, each workpiece and transfer plate is ejected, air cleaned, and returned to the operator at the loading station on a power conveyor. The conveyor is supplied as an integral unit of the machine. Thus, by combining operations, productivity is increased and handling costs are substantially reduced.

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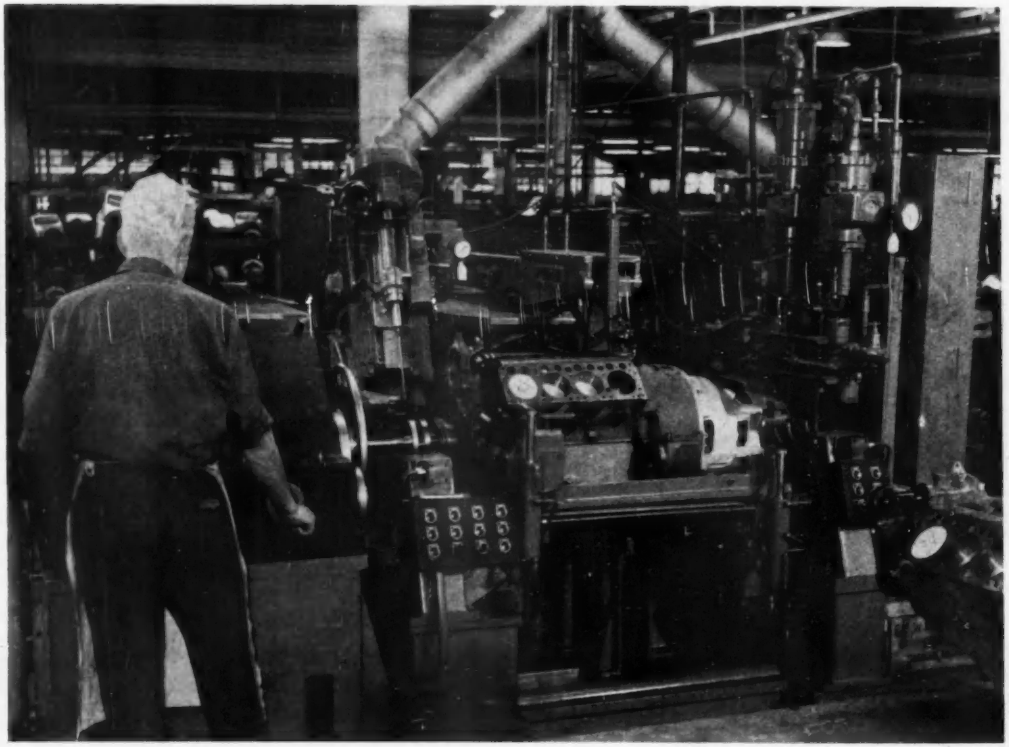
New Machine *Balances* ▲ Engine and Torque Converter

By Joseph Geschelin

ONE of the significant advances in engine building is exemplified in the new Dynetric balancing machine installed in the Chrysler Division East Jefferson plant for the dynamic balancing of Chrysler V-8 engines. As illustrated, this machine, one of a battery of two units, balances the complete engine assembly together with the torque converter, just before the installation of cylinder heads and accessories. Consequently, it is possible to control running balance of the complete assembly. Although the sensitivity of the electronically operated machine can permit limits of balance to a minute degree, the production operation is held to a tolerance of ½-oz in.

From the standpoint of machine operation the im-

View of one of the Dynetric balancing machines installed for dynamically balancing Chrysler V-8 engines complete with torque converter. The master control cabinet is at the left, the balance drill is at the left to the rear of the engine, while the automatic welding head may be seen at the right in line with the torque converter housing.



portant features are: the master control cabinet at the left; the balancing cradle in the center; the balance drill head just to the left of the engine; and the automatically controlled resistance welding head at the right, in line with the torque converter casing.

It may be noted that although equipment for balancing a complete engine has been used for several years, this is said to be the first instance of balancing the complete engine together with a torque converter. The automatic welding head—of projection type—with its equipment and controls is designed to weld a measured strip of steel on the torque converter housing to achieve balance in the right hand plane.

In production operation, the engine assembly is installed in the cradle, coupled to the driving adapter at the left end, and clamped hydraulically. This makes the engine part of the freely suspended cradle. The engine is then rotated at a constant speed of 400 rpm, permitting vibrations resulting from unbalance to vibrate the cradle.

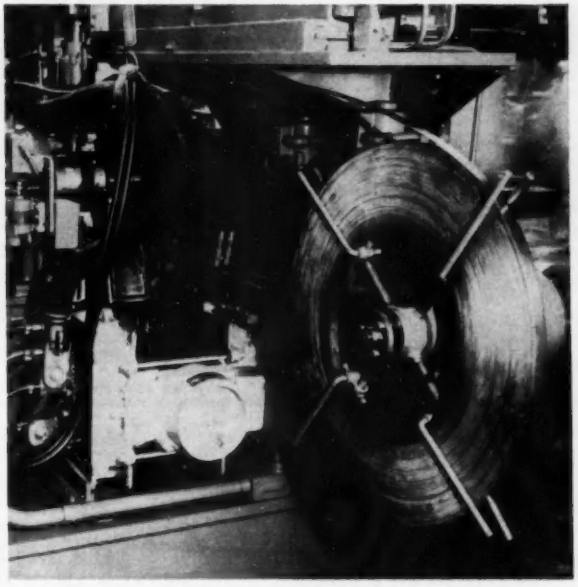
The first reading is taken in the right hand plane. The operator first notes the angle at which unbalance occurs and records this reading on a "dummy" dial for future reference. Then he reads the amount of unbalance. When the latter reading is nulled, the amount is automatically recorded within the welder brain memory unit.

The same operations are repeated for the left hand plane, the "amount" reading being recorded in the drill head brain unit. This time, however, the operator stops the machine and indexes the entire rotating assembly by means of the large handwheel to the point on the protractor corresponding to the "degree" reading for the left hand plane.

When the operator presses the drill start buttons the drill head moves into position for drilling into the vibration damper, the amount of metal to be removed being controlled by the brain unit, by controlling the depth of drill. At the same time the electronic control initiates a succession of events at the welding unit.

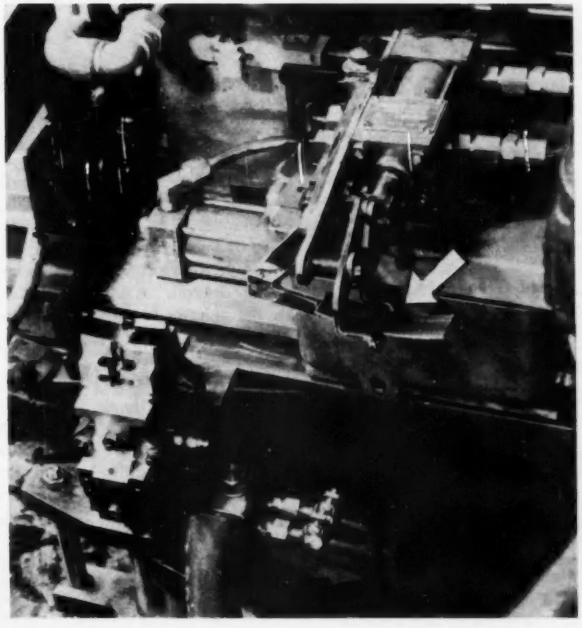
One of the illustrations shows the reel of strip steel mounted at the rear of the welding unit. The first thing that occurs is that the strip is fed forward an exact amount through a set of rollers to form the weight strip to the same radius as the outside diameter of the torque converter housing, so as to

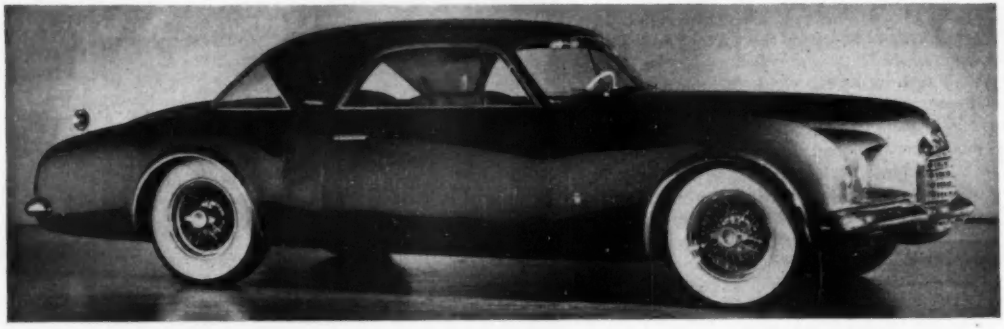
(*Turn to page* 86, *please*)



View taken at the rear of the machine on the right hand end shows the reel which carries the correction strip material. Its feeding action is precisely controlled.

Pliers carrying the cut and formed correction strip may be seen in the center. They are transported on a small conveyor to the welding fingers in the foreground at the left. Here they are dropped into position and held in readiness for the welding cycle.





The K-310 sports car, designed by Chrysler, uses a modified firepower engine developing 310 hp. Built by Ghia of Italy, the body is characteristically Continental with low sweeping lines and a low flat hood.

Chrysler Looks Ahead

By Leonard Westrate

WHEN Chrysler Corp. held an on-the-record showing of its engineering developments in connection with display of its 1952 passenger cars in Detroit, November 8, it revealed for the first time many experimental projects which previously have been highly secret. They were summarized in the Nov. 15 issue (page 17) of AUTOMOTIVE INDUSTRIES. The engineering display was one of the most complete and intelligently conceived demonstrations of automotive development engineering ever staged in the industry.

Of major interest were a new experimental sports car, known as the K310, and the 310 hp modified Firepower engine with which it will be powered. The car is low and wide with marked European styling which would be considered extreme by American standards. The body was designed by the Canozzeria Ghia Co. in Turin, Italy, where it was mounted on a chassis shipped from Detroit. Aside from the high horsepower engine, the chassis is conventional using the Chrysler Fluid-Torque drive. Wheelbase is 125½ in., height 59 in., and overall length 220½ in. The engine develops its high horsepower on standard premium grade gasoline without supercharger.

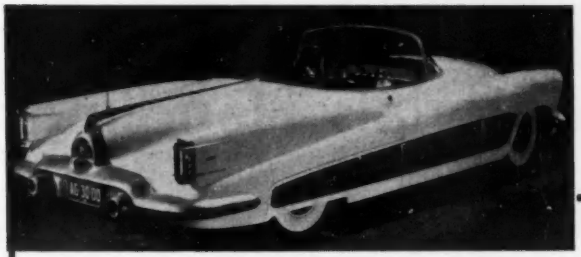
Both valves and valve ports are larger than those used in the conventional 180 hp Firepower engine, which not only permits a larger intake of air fuel mixture, but increases compression ratio to 8.1 to one because of the larger valves. Camshaft changes also have been made. The 331 cu in. engine uses four single carburetors with 1½-in. throats. Chrysler engineers also uncovered a power dividend through changes in the exhaust system. Separate exhaust vents are provided for each cylinder with the vents leading into a single exhaust pipe for each bank of cylinders and leading directly back through individual mufflers to the tailpipe. An increase of 25 hp is said to result from this change in the exhaust system. Also, air is not warmed at the intake as with the conventional Firepower engine, resulting in better volumetric efficiency.

DeSoto V-8 Engine

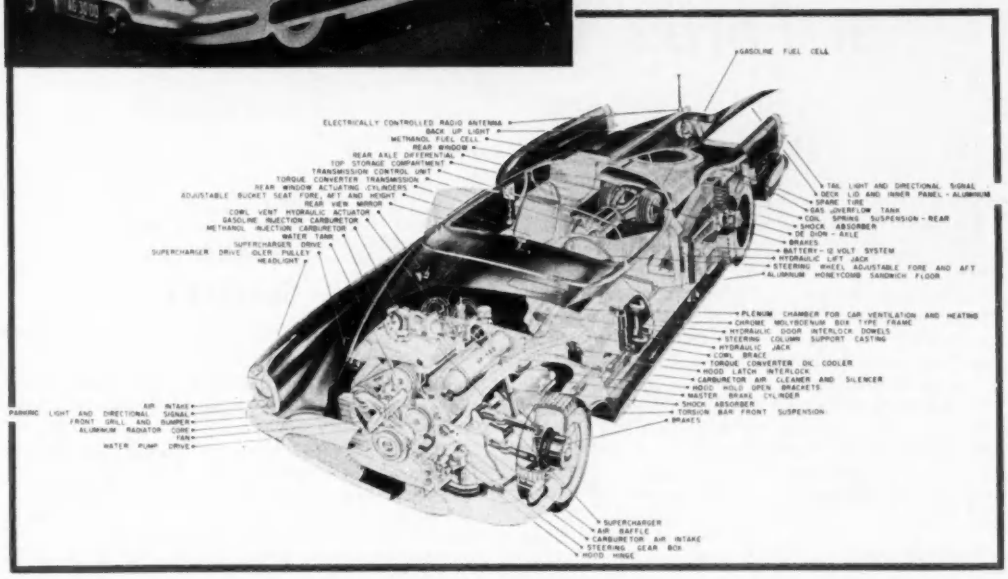
On display also was the new overhead valve 276 cu in. V-8 engine which will be used by DeSoto sometime early next year. It develops 160 hp at 4400 rpm and 250 lb ft torque at 2000 rpm. Bore is 3⅝ in. and stroke, 3 11/32. It has a seven to one compression ratio and in design is fundamentally the same as the larger 180 hp Firepower engine. The engine has a dry weight of 630 lb. Also shown was a horizontal six-cyl. engine originally designed for a prospective light car. It is extremely compact in design with all accessories except the starter located on top of the engine. It is reasonably certain, however, that Chrysler has no serious plans to produce it.

Of considerable interest were the automatic transmissions on display. Chrysler has twelve major transmission programs underway, but showed only three of the units. Of most interest was the fully automatic unit consisting of torque converter and planetary gearing. This transmission is very similar to the one currently being used by Ford and Mercury and it is understood that it will be the next major step in Chrysler's transmission program. It has a maximum

(*Turn to page 64, please*)



Rear quarter view of the XP-300. Extensive use of light alloys — the body panels are made of heat-treated aluminum—makes possible a total weight of only 3125 lb.



Details of Buick's XP-300

HERE is a part-cutaway illustration showing constructional details of the XP-300 which was built by Buick Division of General Motors Corp. for experimental purposes. This special two-passenger sport car, powered by a 300-hp supercharged engine, was illustrated in the March 1 issue of AUTOMOTIVE INDUSTRIES, page 13. A description of the V-8, overhead-valve, 215 cu in. engine, together with illustrations, appeared in AUTOMOTIVE INDUSTRIES, September 1, page 49.

• • •

Van der Horst Discloses New Iron Plating Method

At a recent press preview, it was revealed that a distinctly new plating bath for electrodepositing iron, and a resulting iron called Vanderloy M, has been developed by the Van der Horst Corp. of America, Olean, N. Y.

Microscopically, this new electrolytic iron develops a fine, columnar structure, with the close-packed, columnar grain perpendicular to the surface with which it is bonded. The bond, established atomically between Vanderloy M and the base metal of parts plated with it, is said to be indestructible. Application of enough force to tear one of the metals apart fails to disrupt its atomic adhesion to the other.

The entirely new Vanderloy M type of bath is especially well suited for the plating of heavy deposits. As these deposits build up to substantial thickness, there is neither excessive grain growth nor roughness. Vanderloy M deposits can be made of ¼ in. radial thickness, or more. The limit of thickness, therefore, may be considered as determined by economics and design, rather than by the plating bath.

Distinguishing features of the bath itself are that it remains stable, and produces the above results within practical limits of current density and working temperature. This moderately acidic bath is operated at a compara-

(*Turn to page* 45, *please*)

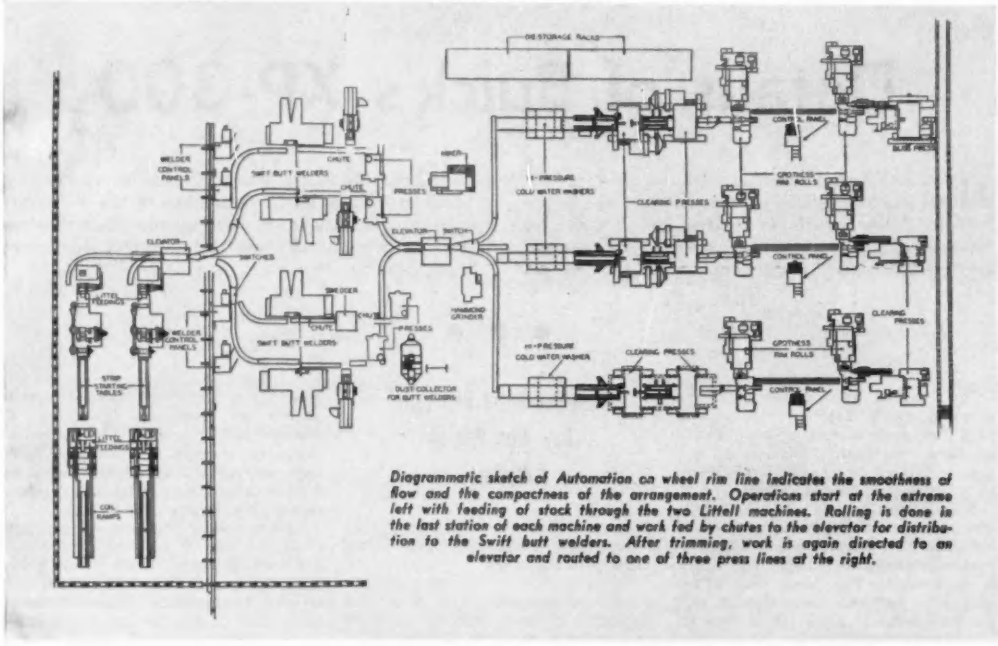
Automatic Materials Handling at Ford's New Parts Plant

By Joseph Geschelin

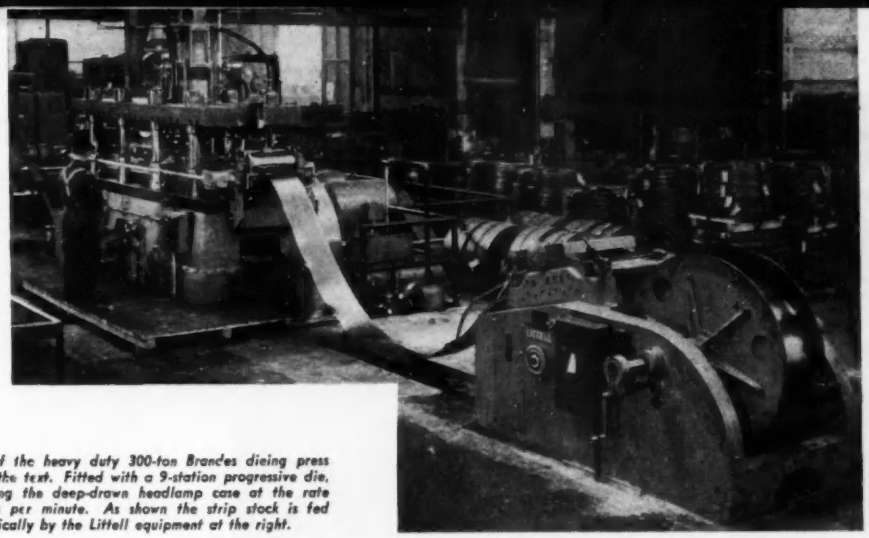
CONTAINING a floor space of some 750,000 sq ft, the new parts plant of Ford Motor Co., in Monroe, Mich., has become one of the basic establishments in the Ford industrial set up. At the present writing it produces zinc alloy and aluminum die castings; the gamut of lamps for Ford, Mercury and Lincoln cars; hub caps; wheels; front suspension coil springs; and truck running boards.

In its original conception the plant was designed to be one of the largest die casting producers in the industry. This is indicated by the scope of the zinc and aluminum die casting departments, as well as the equipment and materials handling system now in operation. In the interim, however, government restrictions on both zinc and aluminum have reduced the volume of work possible in these departments to a mere trickle.

Since this plant is responsible for the production of a large volume of plated parts, it is equipped with an extensive automatic plating department. As a matter



Diagrammatic sketch of Automation on wheel rim line indicates the smoothness of flow and the compactness of the arrangement. Operations start at the extreme left with feeding of stock through the two Littell machines. Rolling is done in the last station of each machine and work fed by chutes to the elevator for distribution to the Swift butt welders. After trimming, work is again directed to an elevator and routed to one of three press lines at the right.



Perspective of the heavy duty 300-ton Brandes dieing press described in the text. Fitted with a 9-station progressive die, it is producing the deep-drawn headlamp case at the rate of 24 strokes per minute. As shown the strip stock is fed automatically by the Littell equipment at the right.

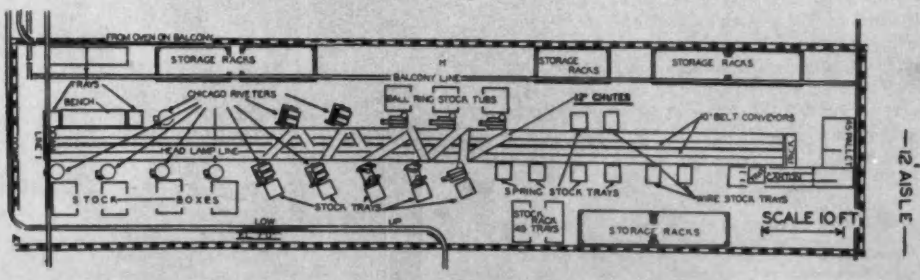
of fact, by the time this article appears they will have in operation a second plating unit, intended for plating steel parts, which is said to have one of the largest copper tanks in use in the industry.

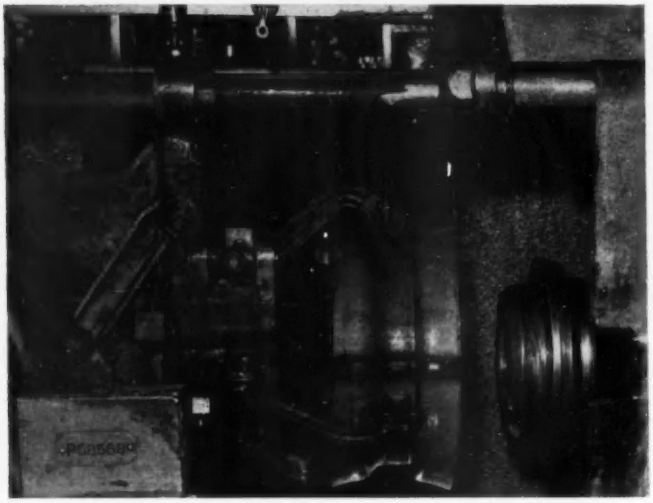
Materials handling is a vital part of the production process in this plant. Not only is it completely mechanized with miles of monorail conveyors of various kinds, but it features some of the most advanced examples of the Ford Automation principle which was exploited at the Rouge several years ago. Automation provides completely automatic control of work movement on the wheel lines, on the coil spring set-up, and in other departments.

Here too is one of the first installations the writer has seen of the heavy duty Brandes dieing presses. The largest of these—a 300-ton unit—is producing the large and deep headlamp case stamping in a nine-station progressive die. At the present time this press is operating at the rate of 24 strokes per minute. Its productivity—considering the nature of the job—is noteworthy when compared with the former method of producing the case in separate settings in a row of small presses.

The plating department too has been affected by Government restrictions. The big new unit for steel parts already has been converted to the procedure of copper on the base metal, followed by chrome flash. The plated surface then is sprayed with a protective clear enamel coating which is baked. This change in procedure necessitated the installation of spray booths and drying ovens as an adjunct to the plating department. (*Turn to next page, please*)

Assembly lines are concentrated in one section of the building, the headlamp line being typical of the layout of individual lines. Two, 10-in. belts make up the "live" section of the line, moving work from station to station. About the center of the line will be noted the network of chutes to facilitate the cross-over of work from station on each side of the assembly conveyor.





This close-up of the work station of one of the rim-rollers shows the new type of "iron hand" developed for this application. In operation, the hand picks up the work, feeds it into the machine, then removes the finished work and ejects it.

The new plating unit, installed by Hanson-Van Winkle-Munning, relies upon good control of bright copper plate. The copper plating tank, said to be one of the largest in use, holds 84,000 gal of solution. The capacity of the plating unit is rated at 5000 sq ft of work area per hour. In operation this unit is designed for continuous movement.

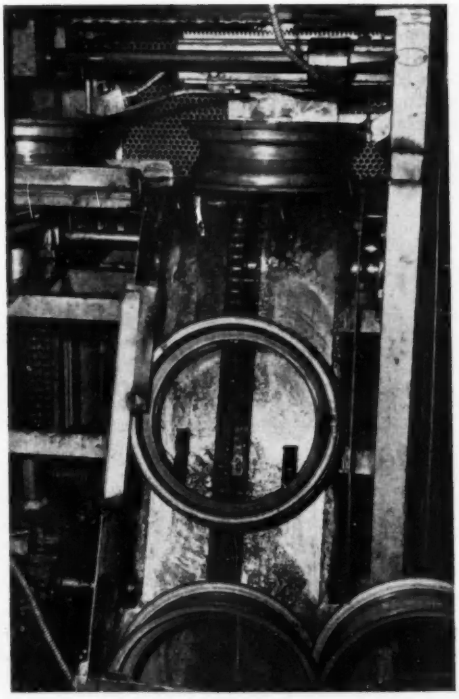
The enormous generator equipment serving this unit has a capacity of 200,000 amp and is capable of providing a current density of 100 amp sq ft. Generators are completely enclosed in a separate room and operated in a forced draft atmosphere for adequate cooling.

The tanks in the system are unusually deep—90 in. —to permit the use of racks 78 in. long, capable of handling work of maximum size. Copper tanks are lined with rubber and have rubber lined filtering units. Tanks containing chromium solutions are lined with Koroseal. All tanks have a protective floor of brick to prevent damage to the rubber lining. Another feature of interest is that anodes are housed in diaphragms. All solution lines are rubber lined, solutions being heated in heat exchangers.

One section of the plant is devoted to self-contained assembly lines for various types of lamps. Of these the most extensive is the assembly line for headlamps with a capacity upwards of 13,000 units per day.

Easily the largest unit in this plant is the press shop, where are located a variety of presses of latest type. Most noteworthy feature of this department is the application of the Ford principle of Automation, representing the latest refinements of this technique. Perhaps the best developed example of Automation is found on the line for producing wheel rims. The entire operation has been made completely automatic through the employment of automatic transfer from one operation to another, including an advanced and simplified version of the "iron hand."

First operation in producing the wheel rim is to straighten, cut off, stamp, and band roll in a large Littel machine. As the work leaves the roll—the last



Here is a close-up of one of the elevator chutes, part of Automation on the wheel rim line. Rims roll to the elevator in a chute to the right, then are picked up by the conveyor and transported to the top. At this point they are pushed into a chute to the left at the upper level for transport to the next operation.

Ford's New Parts Plant *(continued)*

station of this machine—it is ejected automatically into a chute elevator and automatically distributed to a series of four chutes feeding the next operation. This transports the rims to a group of Swift butt welders. The parts are removed from the chutes for the operation, then automatically ejected into a chute leading to the next operation.

Here the work is removed from the chute and fed into a Morton flash trimmer arranged for trimming flash on the OD and ID. It is then removed from the trimmer and loaded into another chute leading to Ferracute presses for trimming flash on the edges. When the part is removed from the press it is placed on a chute which transports it to an elevator where the work is automatically fed to one of three chutes.

At this stage the work goes to a high pressure washer, entering automatically and automatically unloaded and transferred to the next operation. It may be noted that this point on the transfer from one operation to another is entirely by Automation.

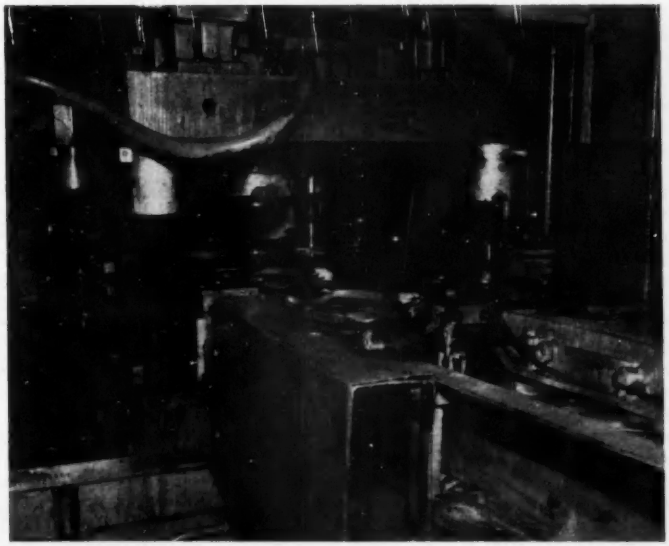
Work has now reached the press operations, first flare being handled in a 400-ton Clearing press, the part being fed automatically into the die, automatically unloaded and moved to the next step. The same procedure is used for handling the second flare, the first and second rim rolling operations, and the expanding of the rim in a 200-ton Clearing press. The rim roller is equipped with the new type of mechanical hand which feeds the rim into the machine and out to the next operation.

Suitable variations of the same procedure have been worked out for handling operations on the wheel spider as well as the assembly of the spider and rim.

Automation also has been applied most effectively in reducing manual handling in the manufacture of front suspension coil springs. The first major operation on this extensive line is the straightening of bars in a No. 2 Medart machine. Stock is conveyed to the machine, later unloaded by the operator and positioned on an elevator for rough grinding. Here a battery of eight Cincinnati Centerless grinders are fed automatically with through feed of stock to the second battery of eight Cincinnati centerless grinders for finish grinding. As the bars leave the finish-grinding operation they are ejected onto a belt conveyor which transports them to an overhead V-channel conveyor. The latter, arranged to pick up the bars automatically one by one, transfers them to one of three end-heating furnaces.

At this stage the bars are moving on a chain conveyor which transports them into an Industrial Heating Equipment gas-fired furnace for heating approximately 14 in. of one end of the bar to a temperature of 1850 F. As work comes out of the furnace it is loaded by Automation and automatically fed into a No. 0 Ajax rolling machine to swage the end. From this point the bars travel on a conveyor and drop one by one to a bar-heating furnace for heating to 1690-1710 F, moving on a screw type conveyor. Bars are ejected one at a time for coiling and stamping in Gogan coiling machines. Out of the coilers the springs are picked up by a quench loading mechanism which loads them into the quenching fixture, then releases the work for the next

(*Turn to page* 64, *please*)



Close-up of Automation on one of the Clearing presses. Stampings are fed to the press on the conveyor to the right, then picked up by the mechanism at the press bed and fed into the die automatically.

Transportation, Fuels and Three National SAE

PROBLEMS related to commercial motor vehicle transportation, fuels, lubricants, and Diesel engines arising from war emergencies and from growing civil and military demands, were enthusiastically discussed at the three recent national engineering meetings held by the Society of Automotive Engineers in Chicago. At these well attended meetings — National Transportation Meeting, National Diesel Engine Meeting, and National Fuels and Lubricants Meeting, there were 24 technical papers presented which covered subjects from automatic transmissions and gas turbine powerplants to a constant compression engine and highway legislation.

A FEATURE this year was that the National Fuel and Lubricants Meeting, customarily held at Tulsa, Okla., was held simultaneously with the other meetings. The joint banquet of the three sessions, had as its guest speaker C. F. Kettering of General Motors Corp., who spoke on "Future Energy Supply." The major theme of his speech dealt with obtaining energy from the sun to use as the world's power supply.

At the transportation meeting, automotive engineers were primarily concerned with ways to improve the speed and agility of commercial motor vehicles. In this respect J. E. Glidewell, Hall-Scott Motor Div., ACF-Brill Motors Co., stated that faster and more agile trucks are essential to expediting delivery and to maintaining speeds sufficient to prevent blocking the flow of normal traffic. He explained that, particularly in mountainous territory, trucks must have sufficient power and speed to reduce long-haul running time, to keep pace with traffic, and to maintain legal road speeds regardless of heavy grades and loads. He further reported that the installation of a Hall-Scott marine engine in a tractor-and-trailer combination provided 450 hp and reduced running time by some 2½ hr on a 320-mile route.

In a paper on the weight-power ratio of commercial vehicles, N. R. Brownyer of Timken-Detroit Axle Co. supported Mr. Glidewell's statement and went on to say that we must make an effort to narrow the pounds per net horsepower ratio between current passenger cars and commercial vehicles.

Another paper presented at this meeting described the experiences in more than a year of operating the Boeing-Kenworth experimental truck equipped with a gas turbine. Henry C. Hill declared that fuel consumption is still rather high—approximately one mpg. He stated, however, that in other ways the turbine has demonstrated marked advantages. While the consumption of fuel may continue to be greater than that of comparable engines of other types, he went on to say that consumption of lubricants is reduced almost to zero. The turbine has shown almost complete insensitivity to the types and qualities of lubricants, operating equally well on compounded and straight mineral oils and even on automatic transmission oils.

It is of interest to know here that a Boeing gas turbine has been installed in a Navy personnel boat for propulsion tests, and a number are being produced under a Bureau of Ships contract to operate electric generators on Navy minesweepers. The Navy has also announced that one of the engines will be tested in a helicopter.

At another well attended session, O. K. Kelley of General Motors Corp. spoke on automatic and hydraulic transmissions for use in commercial vehicles. This paper, which was the topic of much discussion, points out the advantages of combining a torque converter with a Hydra-Matic type gear-ratio mechanism for trucks. Mr. Kelley proposes, what he terms, a mild type torque converter—a converter with a ratio of about two to one—would be advantageous for this purpose.

In speaking before the Diesel Engine Meeting, Sidney E. Miller of the American Bosch Corp., stated that while the design and application of fuel injection equipment to Diesel engines may be a specialized field, satisfactory Diesels must be thoroughly and completely developed also in respect to manifolding, valving, combustion chambers, turbulence, and cooling.

In another session of the same meeting, 17 years of Diesel engine cold-weather starting tests—conducted by the Naval Engineering Experiment Station—have revealed the need for developing mechanisms to keep engines warm enough for rapid starts regardless of temperature, according to James F. Blose. He proposed the development of some starting system not entirely dependent upon electric storage batteries and capable of being recharged at sub-zero temperatures by means other than manual labor, and the installation of engines and batteries in insulated compartments with a thermostatically-operated starting switch automatically starting the engine whenever the temperature falls.

Engines Discussed at Meetings

Cold-weather operation of military engines and automotive equipment was reported on in a paper by P. W. Espenschade, R. C. Navarin, and W. W. VanNess, of the Fort Belvoir Engineer Research and Development Laboratories. They explained that because of expectations that any future war might be concentrated in the Arctic regions, automotive equipment powered by Diesel engines must start when needed and function regardless of temperature.

The Diesel Engine Meeting was also informed that the Dieselization of railroads has reached the halfway point. It was reported that some 14,000 Diesel locomotives producing a total of 17,500,000 installed horsepower are now operating on American railroads. This was brought to light in a paper by Ernest K. Bloss, of the Boston & Maine Railroad.

A very interesting paper, The Humphreys Constant-Compression Engine, presented at the Fuels and Lubricants Meeting, was the subject of much discussion by eminent men in the automobile industry, as well as the petroleum industry. This paper was prepared by W. H. Paul of Oregon State College, and I. B. Humphreys of the Humphreys Investment Co., Denver, Colo.

The gentlemen who offered discussions concerning this development were E. F. Caris, General Motors Research; V. Raviolo, Ford Motor Co.; M. M. Roensch, Ethyl Corp., and L. S. Echols, Shell Oil Co.

Walter Cornelius and John D. Caplan of General Motors Research Laboratories described at one of the Fuels and Lubricants sessions, how they deliberately heated the air-fuel mixture of a spark ignition engine to 300 deg to find out whether pressures resulting from these chemical reactions snuffed out some of the engine's power. They found that when the mixture heat was boosted to the 300-deg level, the power loss from so-called precombustion reactions was noticeable.

"Diesel fuel ignition quality, supplied by the addition of amyl nitrate, compares favorably with that inherent in a clear fuel of the same cetane number for a wide range of Diesel engine operating conditions," according to Merrill J. Anderson and Grover C. Wilson of Ethyl Corp. In a paper presented here before fuels and lubricants session, the authors reported that overall cetane-number requirement for the full-scale engine tested is greater for low-load, low-speed operation than for high-speed, high-load operation. Amyl nitrate provided ignition quality which was effective in both ranges of engine operation, Wilson pointed out.

The following are abstracts or extracts of some of the papers presented at the three meetings:

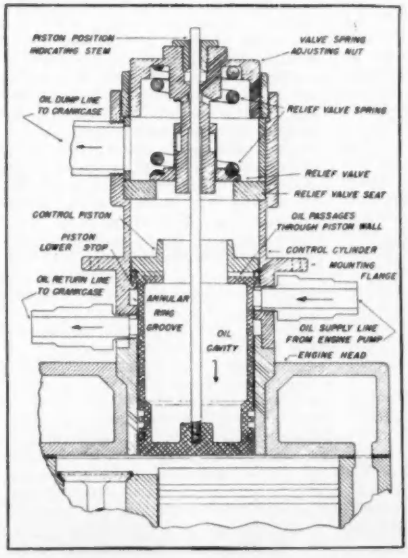


Fig. 1—Sectional view of the Humphreys constant-compression mechanism.

The Humphreys Constant-Compression Engine

By **W. H. Paul**, Oregon State College and **I. B. Humphreys**, The Humphreys Investment Co.

The constructional features and details of operation of the Humphreys constant-compression engine can best be described by reference to Fig. 1. It will be apparent that this unit is of the movable piston type. The control cylinder is mounted vertically above the power cylinder with its inner end opening into the combustion chamber. In production, the lower end of this control cylinder would ordinarily be an integral part of the cylinder head casting. The upper section of the control cylinder is secured to the lower section by studs projecting from the cylinder head through a mounting flange. Within the control cylinder there is a freely moving piston, enlarged at its upper end to provide oil-cushioned limit stops. To indicate at all times the position of this control piston, there is provided a light rod stem extending from the crown through the top of the unit. A generously proportioned,

spring loaded relief valve closes the top of the control cylinder. Tension of the spring may be varied with an adjusting nut. The space above the relief valve is open to atmospheric pressure. A large oil dump line connects to this space. Between the inner crown of the control piston and the relief valve seat is an oil cavity in which fluid is always present. This cavity is supplied with lubricating oil from the crankcase of the engine by the lubricating oil pump. The inlet passage is indicated at the right side of the drawing. Oil, at the system pressure, is forced into the oil cavity by way of an annular ring in the cylinder wall, then through a restricted passage around the piston lower stop to a ring groove in the enlarged section and thence through drilled passages in the piston wall. Obviously, there is a considerable pressure drop through this restricted passage, but such is necessary in order to retain the oil in the oil cavity under conditions of fluctuating pressures. An oil return line, shown at the left, serves to collect leakage from the annular ring in the supply line. This

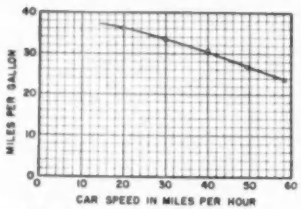


Fig. 2—Mileage graph of the Oldsmobile 76 fitted with the Humphreys constant compression device.

line also bleeds off any combustion gases which may leak past the auxiliary piston. Maximum travel of the auxiliary piston is approximately 1¼ in. in the experimental engines. Movement of the auxiliary piston varies the compression ratio from about 6½ to one to 15 to one.

Since the principal purpose of the auxiliary control piston is to automatically maintain constant compression pressure with change in load, let it be assumed that the load is light, such as at idling or some low level-road speed. The control piston is maintained in its highest compression ratio position (lowest position in cylinder) by virtue of the fact that the oil cavity is full and there is no appreciable flow through the relief valve or any of the other outlets. With a manifold absolute pressure of about six psi and a compression ratio of 14, the theoretical compression pressure will be about 200 psia. Let the throttle be suddenly opened fully. On the first cycle the compression pressure and the resulting maximum pressure will be high. This high pressure is communicated to the oil in the oil cavity and acts to open the relief valve. Due to the liberal size of the relief opening the oil is discharged quickly into a region of atmospheric pressure. The discharge of oil allows the control piston to move sharply toward the opposite extreme. Termination of upward travel is cushioned by oil partially trapped between the under side of the relief valve seat and the shelf on the piston. The control piston will remain in the top of the cylinder position as long as the load is full or heavy, that is, as long as the pressure within the engine cylinder transmits a force to the relief valve in excess of the spring loading. During the time in the cycle when the gas pressure is low, the pressure produced by the lubricating oil pump will tend to force the piston down toward smaller clearance volume. On the next cycle the combustion pressure will force it back. Thus at full load there is a very slight, but noticeable, oscillation of the control piston. Some small amount of oil is being fed in and dumped each cycle. Under full load the manifold absolute pressure will be about 14 psi and a compression ratio of approximately seven will produce a theoretical compression pressure of 200 psia, the same as at the lighter load with 14 compression ratio.

Consider an intermediate load (about 40 per cent) where the control piston comes to rest at some fractional part of its travel. Assume the part load is attained instantly from idle. To have left its lower position there must have occurred a cycle in which the maximum pressure was high enough to open the relief valve. This would allow the piston to move upward and decrease the compression ratio. Such movement would lower the maximum pressure on the next cycle. If the maximum pressure were not high enough to open the relief valve, the control piston would recede to a point of higher compression ratio. The next cycle would dump a little oil and reposition the piston. Thus there is a constant motion of the piston caused by the combination of oil relief and supply. At such an intermediate load it may be estimated that the manifold absolute pressure would be about nine psi. A compression ratio of about 9.5 would give the constant compression pressure of 200 psia.

Thus it may be seen that the Humphreys engine, when operating within the limits of its variable compression ratio, has both constant compression pressure and constant maximum pressure. This seeming paradox is possible through the inverse relationship between compression ratio and the mass of the inducted charge.

Under light load (up to about 30 per cent of maximum brake horsepower at any speed) most gasoline engines will tolerate 12 to one compression ratio with regular grade fuel, without knock. In support of this statement it is known that the General Motors 12 to one experimental engine will operate at sea level on regular grade fuel up to a level road speed of at least 70 mph. This is equivalent to a 35 per cent load on a brake basis. It is, of course, realized that some of our present-day engines do develop low-speed knock, but such has not been experienced in the Humphreys design. Up to about 55 mph on level road, the Humphreys adaptation to an Oldsmobile 76 engine operates on regular grade fuel without knock with the control piston in the highest compression ratio position. That highest compression ratio is about 14 while the lowest is approximately 6.5.

When the relief valve springs are set to barely open under full load, they keep the relief valve completely closed at all loads less than about 30 per cent. This means that the present Humphreys design operates as a fixed high compression ratio engine in the first 30 per cent of its load range. In this respect, it is not different in principle from the high compression ratio General Motors engine for which the economy performance has recently been made public.

As stated previously, the Humphreys constant compression conversion has been adapted to a six-cylinder automobile engine. In addition to numerous checks of trip mileage, this automobile has been carefully tested for its single-mile, constant-speed, fuel consumption. Acceptable techniques and reliable apparatus were used. These tests were made in Denver, at an altitude of approximately 5000 ft, which if anything, would cause the mileage to be lower than that obtainable at sea level. Fig. 2 is a graph of the mileage curve. It was obtained with regular grade fuel and represents, over its entire range, operation at about 14 to one compression ratio.

Air-fuel ratio, although not accurately determinable, was estimated to be about 17 to one. It will be noted that the 50 mph mileage of this car is about 26.5, while 17.5 mpg at this speed is the comparable normal mileage. This 50 per cent improvement, while sounding optimistic, is yet in line of GMC reports on their 12 to one engine.

It should also be stated that both the top speed and hill-climbing performance of the car have not been impaired by the application of the Humphreys unit.

Discussion of Humphreys Constant Compression Engine

By L. S. Echols
Shell Oil Company

A MULTITUDE of problems are imposed upon the refining industry by the continuously increasing demands for gasoline both in terms of volume and antiknock quality. Any engineering effort which would tend to offset the trend to higher octane requirements must be viewed with great interest. The proposal by Messrs. Humphreys and Paul is a definite step in this direction, there being little doubt that the type of operation proposed will permit octane requirements to be kept at a comparatively low level.

However, a serious question arises in respect to gains in performance and economy which may be achieved via this route. Mr. Humphreys has referred to the increases in road economy effected by General Motors in the development of their new high compression engine, pointing to increases of as much as 39.5 per cent between engines having compression ratios of 7.5 to one and 12 to one respectively. It is important to recognize that these gains were by no means ascribable entirely to compression ratio and in fact were largely due to other factors. The 12 to one compression ratio engine design incorporates many features which improve road economy as compared with earlier engines and a clear conception of the isolated effect of the compression ratio can only be secured by tests in a given engine at several compression ratios. Accordingly after a study of Mr. Humphreys' paper we have converted some of our data on a G.M. Research V-8 engine into a form which permits a comparison of the Humphreys proposal with the normal engine as shown in Table 1. In this comparison two cases were considered in which the available fuels were assumed to be of 95 octane number (research) and 90 octane number respectively. Normal engines operating on these two fuels, would operate at 8 to one and 6.9 to one compression ratio respectively at full load. The comparisons are given in terms of full throttle brake horsepower and road load miles per gallon at 40 mph. Data on the same basic engine are shown under conditions simulating Humphreys' type of operation in which compression ratios during full throttle acceleration are at the trace-knock level, while at road load the compression ratio is increased to a value of 12 to one. With 95 octane the Humphreys engine has an advantage in fuel economy of 7.5 per cent rising at the 90 octane number level to 11.5 per cent. These tests were run under optimum conditions of fuel-air ratio and spark timing. The octane requirements at normal distributor settings are considerably lower than the 90-95 levels indicated and correspond to 84 and 91 octane number respectively. These are in the range of present commercial fuels. It will be noted the per cent gain in economy with the Humphreys engine tends to be greater as the octane number of the available fuel is lowered. It should also be noted that the maximum economy fuel-air ratio in this engine shows no substantial trend toward leaner mixtures with increased compression ratio.

These modest gains are in contrast with those quoted in the subject paper and the question arises as to the source of the difference. Normally an increase in compression ratio increases full throttle power and permits a lower axle ratio and a smaller engine to be employed without loss in performance. This change alone accounts for an additional 14 per cent increase in road economy. The Humphreys engine does not permit the gains in full throttle power normally available with increased compression ratio. Hence the reduction in axle ratio cannot be taken without a loss in acceleration performance. Application of an overdrive giving a 2.75 axle ratio to the Humphreys engine at the 90 octane number level would raise the road economy to 126 per cent. The same overdrive would raise the normal engine to 113 per cent; hence a slight increase in the margin of the Humphreys engine would result.

Table I

Comparison of "Normal" and "Humphreys" Engine
From Research V-8 Engine Data
(40 mph—3.23 gear ratio)

Research Octane Requirement:	95 (90.5)[1]					90 (84)				
	Full Throttle[2]		Road Load[3]			Full Throttle		Road Load		
	CR	BHP	CR	ml./gal.	% Economy	CR	BHP	CR	ml./gal.	% Economy
"Normal" Engine (Fixed Comp. Ratio)	8:1	98	8:1	23.1	100	6.9:1	93	6.9:1	22.3	100
"Humphreys" Engine (Variable Comp. Ratio)	8:1	98	12:1	24.9	107.5	6.9:1	93	12:1	24.9	111.5
Addition of an overdrive to give 2.75 axle ratio						"Normal"			25.2	113
						"Humphreys"			28.1	126

[1] Figure in parentheses denotes octane requirement with normal distributor setting.
[2] Full throttle data at maximum power spark timing.
[3] Road load data at maximum economy spark timing and fuel/air ratio.

Automatic and Hydraulic Transmissions

By O. K. Kelley
General Motors Corp.

To deliver the optimum performance in the hands of all kinds of drivers, the ideal highway truck transmissions would be fully automatic, highly efficient, non-hunting drive. This transmission should be designed in combination with the engine, and the number of gear steps used to cover the difficult part, the top six to one drive range, established to suit the engine characteristics. The additional ratios to meet the 16 to one total ratio requirement are relatively easy to obtain. The real problem is the high efficiency top six to one coverage. It is not possible to design a transmission using automatic gear ratio changes under full power, without inherent tendency to hunt on some grade, unless the horsepower delivered into the transmission is the same before and after the shift. It requires the same delivered horsepower at the wheels to continue the performance after the upshift as it did before. The same horsepower can not be delivered to the wheels if it is not first delivered to the transmission's input. In other words, the engine should be producing the same horespower before and after the shift. Fig. 1 illustrates the point. A typical heavy duty engine has a fairly flat torque curve and a fairly rapidly rising horsepower curve up to the governed speed. Operating with a transmission of 1.2 gear steps,

(Turn to page 68, please)

Automatic Machines Produce Strong, Economical Spinnings

Close-up of the work station of the spinner, showing the spinner ram in the background.

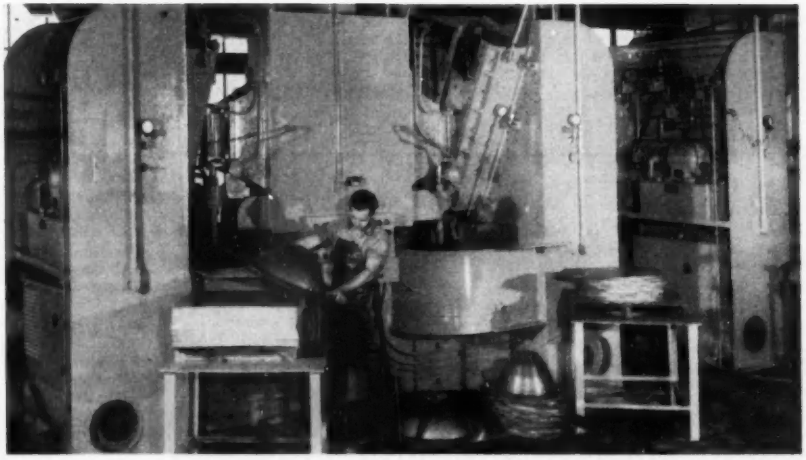
By Darwin S. Cox
Asst. Vice President,
United Specialties Co.

DEVELOPMENT of versatile automatic spinning equipment at the Chicago plant of United Specialties Co. has opened up an entirely new field. United Specialties tooling engineers, who keep about 140 blanking and drawing presses in production are now giving a great deal of time to combining spinning and drawing.

Many design engineers are not familiar with spinning and many who are familiar with this method of metal forming have felt that it is too slow and costly, does not permit the use of heavy gage materials, or does not afford sufficient control for accuracy. This was true some years ago but today, with the use of electrically controlled hydraulic spinning machines, such objections have been overcome. In the past year more and more design engineers have become conscious of the savings to be realized through this production method.

(*Turn to page* 88, *please*)

This is a close-up of one of the big hydraulic spinning machines developed by United Specialties Co. As shown, it is of two-station type. The operation starts with a suitable blank, produces the cone-shaped work held by the operator.



Italian "Jeep" in Production

FIAT has recently gone into production on an all-purpose cross-country passenger car, known as the "Countryman," which corresponds in its general features to the American military jeep. The Countryman uses a four-cyl valve-in-head engine of 116 cu in.—bore and stroke is 3.2 in. by 3.5 in.—which develops 53 hp at 3700 rpm. Compression ratio is 6.7 to one.

Power is taken through a four-speed transmission to a reduction gear, and then to a conventional type rear axle by an open driveshaft. Four-wheel drive is provided by a driveshaft from the reduction gear to the front axle housing. The two-speed reduction gear along with the four-speed and reverse transmission gives a total of eight speeds forward and two in reverse. A power take-off is provided from the reduction gear to a pulley shaft mounted transversely behind the rear crossframe member.

The front wheels feature independent suspension with hydraulic shock absorbers. Semi-elliptic springs are used for the conventionally sprung rear.

This all-purpose vehicle has an all metal body bolted to the chassis with a top consisting of metal bows and canvas. Seating capacity is six persons, and the total useful load is 1100 lb. including passengers. According to the company, it can haul trailers up to 6600 lb. Maximum road speed is said to be 62 mph.

The Fiat four-wheel drive car bears a marked resemblance to the American Jeep.

Featuring a 116 cu in. valve-in-head engine, developing 53 hp at 3700 rpm, the Fiat "Countryman" is said to have a top speed of 62 mph.

Other features of the car include a 12 v electrical system, headlights set flush in the radiator grille, 6.40 by 16 tires mounted on disk wheels, and complete waterproofing up to the top of the wheels.

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(*Continued from page* 35)

tively low temperature which permits masking with the easy and low-cost use of wax. Since all substances remain completely dissolved, the bath is a true solution and, therefore, lends itself either to continuous or periodic filtration.

Variations in bath composition and plating conditions can produce Vanderloy M with a tensile strength as high as 100,000 psi or as low as 50,000 psi. For the present, the established conditions for production approximate physicals averaging as follows: tensile strength, 75,000 psi; yield point, 60,000 psi; Brinell hardness, 200-210.

Vanderloy M, as now plated on outside diameters and surfaces, machines about the same as alloy steels with a tendency to be tough. Machining can be accomplished, however, with high-speed steel cutters. Machining of inside bores is more difficult, but honing and grinding, of course, are readily done.

With this new Vanderloy M process, worn bearing surfaces are built up again to new condition with electrolytic iron. As a typical example, renewal of a 20-in. Diesel cylinder liner is accomplished with 12.3 lb of Vanderloy M. This saves 1720 lb of high-quality casting and extensive machining, for which the price of replacement is approximately $1,550.

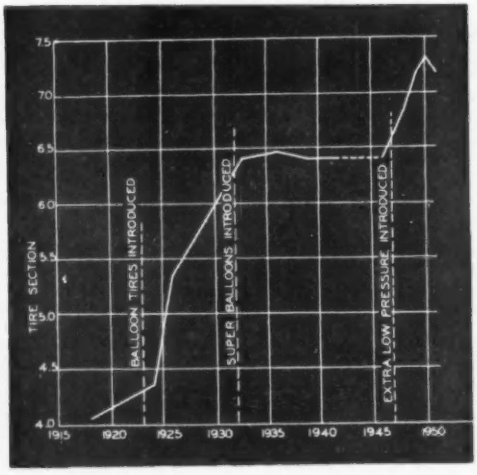
Power Steering for Modern

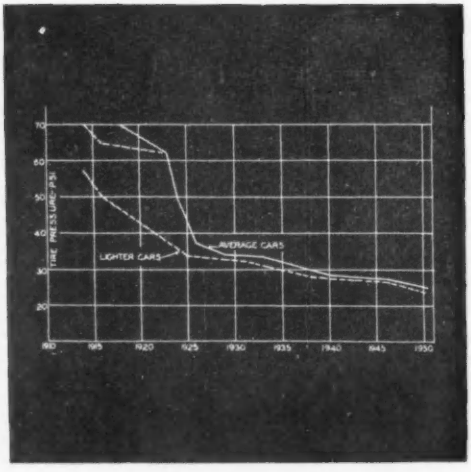
In This First Part of a Two-Part Article, the Author Discusses the Development of Various Types of Power-Assisted Steering Mechanisms and Points Out Their Features and Advantages. Part II, Which Will Appear in an Early Issue of AUTOMOTIVE INDUSTRIES, Will Be Devoted in General to Principles of Operation and Description of the Various Devices of This Kind Now Available.

By Edmund B. Neil

WITH the introduction this year of power steering as standard equipment on the Chrysler Crown Imperial model, and as optional equipment on two other models, the final phase of a long series of developments in this form of steering has been reached. Chrysler is to be credited with the first passenger car production installations of this means of affording the driver not only a new ease of steering, but other advantages not so readily evident to the car owner, and still others to the automobile manufacturer.

Power steering has been in actual use for many years on heavy-duty motor trucks and military vehicles. It has been under active development for passenger cars for nearly 25 years. Recently a number of buses have been equipped with the type of power steering to be discussed herein, so that up to date the total number of installations is in the five-figure range. The type of power steering to be discussed more properly should be termed "power-assisted" steering or perhaps "servo-steering" since all the basic elements of the conventional steering mechanism are retained, as distinguished from types entirely dependent upon a power source to perform the steering



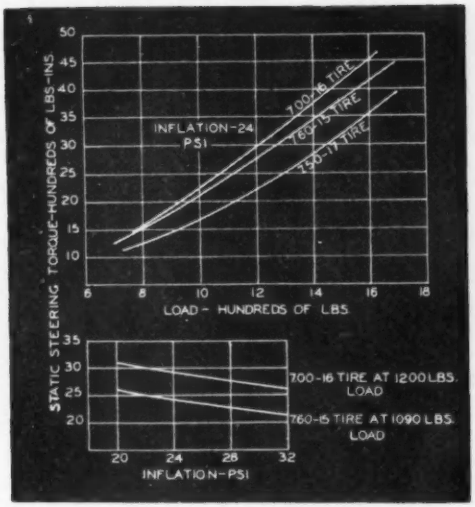


Vehicles

PART 1

function. The latter types are confined to certain off-the-road vehicles, to some military tanks, and to large marine vessels.

Examination of early patents shows that the possible need for reducing the effort required to steer an automotive vehicle under severe conditions was recognized some 45 years ago. With the steering ratios used during the next fifteen years in large motor trucks equipped with solid tires (11 to 1) steering control could be lost in deep snow and mud (1). Dual ratio steering gears, gears with two steering wheels, or means of quickly shifting from one ratio to another were designed (2). Damping devices were evolved to reduce the "reversibility" existing in gears with low (numerical) ratios. Thus, when higher ratios were adopted shortly thereafter (12 to 1 up to 17 to 1 for two to five ton trucks), a certain advantage accrued from the inefficiency of the gears. It was then absolutely necessary for the driver to keep the vehicle moving slowly to reduce

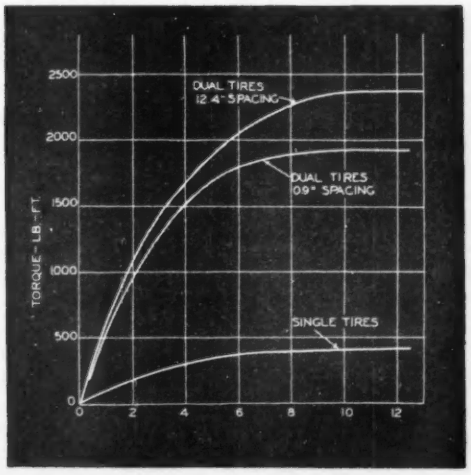


STATIC STEERING TORQUE PASSENGER CAR TIRES

Upper chart—Effect of Load, Lower chart—Effect of Various Inflation Pressures. 7.50-17 tire—six-ply rating, others 4-ply. Notice that increase in load has a much greater effect than reduction in inflation pressure on torque.

Torque of Super-Cushion tire is slightly less than for earlier standard 7.00-16 tire due to shorter tread contact area.

Data for charts Courtesy R. D. Evans and Goodyear Tire and Rubber Co. 7.00-16 and 7.50-17 tires standard Goodyear. 7.60-15 tire, Goodyear Super-Cushion type.



TREND IN AVERAGE TIRE SECTION

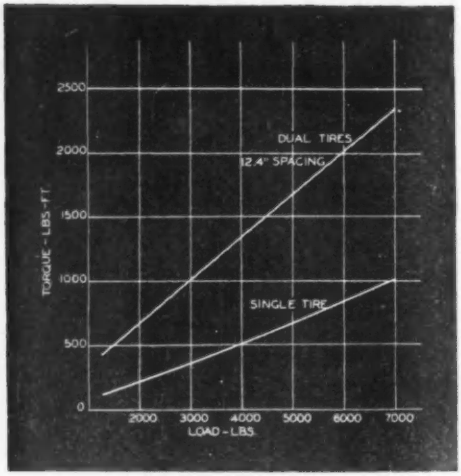
(Far left)—Average section has almost doubled in this period. Sections of tires for low-priced cars have more than doubled. Slight decrease in section for 1951 compared with 1950 is due to introduction of two makes of cars of smaller than usual size in 1951.

TREND OF PASSENGER CAR TIRE INFLATION PRESSURE

(Center) Pressures today are less than one-half those of earlier years. A slight increase for 1951 on some cars is balanced by adoption of 8.00-15 tires using 24 psi. Dash line at top indicates discrepancy between sources used in compiling this chart.

STATIC STEERING TORQUE FOR 9.00-20 GOODYEAR TIRES, SINGLE AND DUAL MOUNTINGS, LOAD PER TIRE 3500 LB., INFLATION 65 PSI.

(Near Left)—Torque increases with turning angle to a maximum at 8 to 10 deg. Spacing of dual tires materially changes required torque. Tests on dual tires relate to extremely heavy front axle loads, as for off-the-road and military vehicles. (Chart courtesy Goodyear Tire & Rubber Co.)



MAXIMUM STATIC STEERING TORQUE WITH VARYING LOADS, 9.00-20 GOODYEAR TIRES— 65 PSI INFLATION PRES.

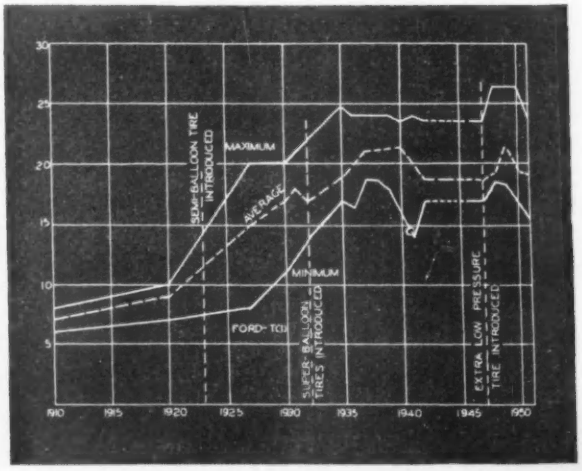
Static torque is roughly proportional to load. (Chart courtesy Goodyear Tire & Rubber Co.)

the steering wheel force sufficiently to cause the front wheels to turn. This condition continued to exist until ratios were vastly increased and steering gear efficiencies raised from 40 or 50 per cent to 75 per cent, and higher.

Although the first power steering mechanism was applied to a passenger car in the late 1920's, (3) it was a mechanical servo unit or torque amplifier, and for what now seem to be obvious reasons, no further development of this type occurred. At about the same time the first hydraulic type was installed on a passenger car (4). A few years later types employing vacuum, compressed air and electrical control appeared, first in Europe, (5) the vacuum and compressed air types undergoing further development. These developments, especially that of the hydraulic type, formed the basis for power steering devices on heavy-duty vehicles. It may thus seem peculiar that since the first power-steering units appeared on passenger cars, no production application took place until this year, but there are definite reasons for this.

In the years between 1928 and 1951, steering effort was reduced through the use of more accurate finishing of the internal parts of the gear, the adoption of anti-friction bearings therein, the development of the variable-ratio steering gear, and the reduction in friction of steering spindle pivots and the link of connections in the steering assembly. Increased gear and linkage efficiency combined with increasing the steering ratio until recently kept steering effort within acceptable limits. These changes have been considered sufficient to offset the increased weight of passenger cars, even as aggravated by the greater proportion of total weight carried on the front wheels, increases in rim widths and tire cross-sections and reductions in inflation pressures which have taken place. However, many engineers over the years have criticized the reductions in steering responsiveness occasioned by the large increase in steering ratios necessitated by these changes. On large motor vehicles, especially those engaged in services where control was essential under all conditions, or much turning of the front wheel was required, as in local bus service, the improvements in gear and linkage efficiency along with increased ratios has not been sufficient to keep steering effort within

(*Turn to page* 90, *please*)



TREND OF PASSENGER CAR STEERING GEAR RATIOS

Ratios today are from three to four times those used with earlier high-pressure tires. Notice further increases when ELP tires were introduced. Decreases in 1951 due largely to introduction of two new small cars. Ratios shown are for steering gear in straight-ahead position. Overall ratios may be much higher. Front drive cars are not included. (1) Light type not included except as noted.

Pontiac 1952 Catalina model.

Pontiac Offers Dual-Range Hydra-Matic for 1952

Manual control for the new Dual-Range Hydra-Matic drive.

In unveiling its offerings for 1952, the Pontiac Motor Division of General Motors Corp. has introduced a combination of mechanical features designed to increase performance and safety. A major item of interest is the new Dual-Range Hydra-Matic transmission which provides a choice of two high driving ranges at the option of the driver. This drive is offered as optional equipment in combination with eight- and six-cylinder engines with compression ratio upped to 7.7 to 1, boosting output of the eight to 122 hp, while the six is raised to 102 hp.

In addition, Pontiac makes available a new rear axle ratio of 3.08 to 1 with Dual-Range drive to provide smoothness and quietness on the highway, together with increased fuel economy.

The 1952 line includes—Super DeLuxe Catalina, DeLuxe Catalina, four-door and two-door models, Station Wagons, and Sedan delivery. The former Streamliner series and coupe models have been dropped. Two-door and four-door models, as well as Station Wagons are available in standard and deluxe interior and exterior trim.

Dual-Range Hydra-Matic, frequently discussed in recent months, has a choice of two high range ratios, selected by the driver. The highway driving range, the "DR" position at the left on the control, brings into play the usual four speed transmission range. This range, coupled with the economy rear axle, reduces engine speed at high road speeds, reduces noise, and is said to improve fuel economy.

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METALS

Higher Copper Price Seen as Inevitable with Europe Paying Above U. S. Figure. Lead Now is Really Scarce

By William F. Boericke

Most Critical Material

Copper is named by the Defense Production Administration as the most critical on its materials list. Copper supplies are described by the agency as "almost dangerously short." Two disasterous strikes, a prolonged decline in scrap deliveries, continued low imports, and the work stoppage on the New York docks that tied up about 20,000 tons of foreign copper all combined to make the supply situation extremely difficult. As a direct result of the metal shortage the big brass fabricators in the Connecticut Valley were obliged to cut output to nearly half of capacity and to go on a four-day week.

Despite the scarcity of copper metal and the wide disparity between the domestic ceiling price and the quotation abroad, which is about double the 24½ cents a pound allowed in this country, OPS has announced that no action is contemplated for an upward revision of the ceiling price for primary copper and scrap. The reasoning behind this decision appears to be that a higher price would not bring out any more production from the domestic mines which are working at capacity and to pay more for foreign metal would simply remove that much copper from western Europe where the metal is as vitally needed for defense purposes as it is here.

Nevertheless the trade believes that a higher copper price is almost inevitable. West Germany has contracted to buy the entire output of the Chilean government-owned Paipote smelter at 54 cents a pound and the Lepanto copper mine in the Philippines has sold half its output to the same country at 37 cents. In neither country is a large tonnage involved but the prices are typical of what Europe is willing to pay.

Guaranteed Copper Price

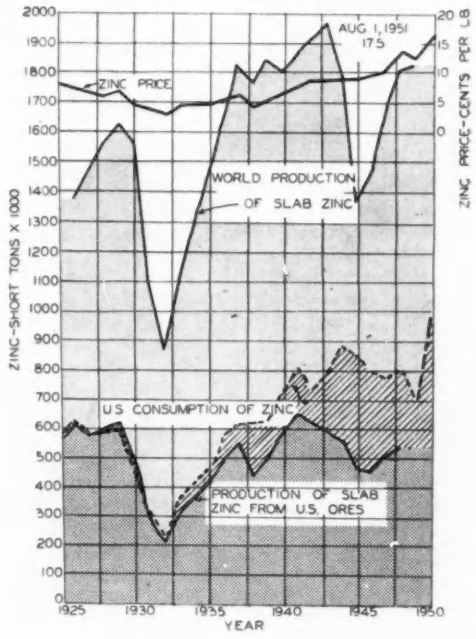
What virtually amounts to a guaranteed price for copper over the next five years has been granted by the Defense Procurement Material Agency to several large copper producers as an incentive to increase output. Unfortunately this contemplated increase will not materialize for several years. Magma Copper Co. gets a floor of 23½ cents a pound for seven years, Phelps Dodge gets a guarantee of a few cents below 24½ cents for its new East Bisbee project and Anaconda Copper 25½ cents for metal from its new Yerington development. This appears to reflect the belief of the Government officials that there is no likelihood of any flood of copper coming on the market either here or abroad that would cause the price to drop to prewar levels in the foreseeable future.

The DPA Administrator has declared that companies using copper for least essential goods can only expect allotments as low as 15 per cent of 1950 levels in 1952. In line with this the advice is freely given to use substitutes for copper if at all possible, in particular to try aluminum.

For the first nine months of 1951, U. S. production of crude copper has averaged about 3000 tons a month less than in 1950 and for the rest of the world no increase over 1950 is reported. With demand steadily rising in Europe it is apparent why copper exports to the United States have fallen to a monthly average of 30,000 tons as compared with 40,000 in 1950 and why it is wishful thinking to expect they will increase to any extent.

Zinc in Better Supply

Of the three major non-ferrous metals, zinc alone appears to be in improved supply although consumers



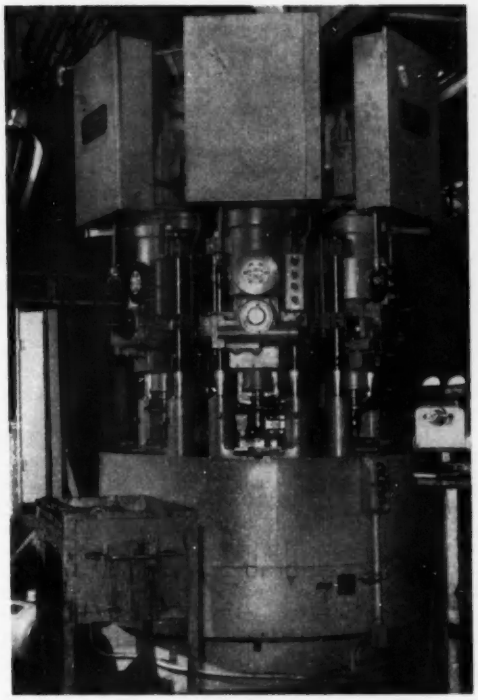
are still asking for more metals than the tonnages allotted to them. However, there is more than a faint suspicion that consumers have placed orders for more metal than they really expected to use so as to insure

(*Turn to page* 58, *please*)

Connecting Rod End ID Finished in New Machine

One of the earliest installations in the industry of the new Micromatic Turret-Hone machine, the six-station honing machine, is found in the Buick engine plant for honing the big end of Super engine connecting rods. Unlike the two-spindle machines made by the same company, the Turret-Hone features mechanical ram operation, and uses special five-stone honing tools. Honing of the Buick rod is an extremely exact operation, the diameter of the big end being held to a tolerance of 0.0003 in.

Special arrangements are required to assure maintenance of such close tolerances and fine surface finish. The machine has been fitted with a Barnes-drill magnetic separator to filter the coolant and keep it clean to prevent marring of the honed surface. In addition, it is equipped with a Frostrode refrigeration unit through which the coolant is circulated and held to room temperature under close thermostatic control.



Micromatic Turret-Hone six-station machine.

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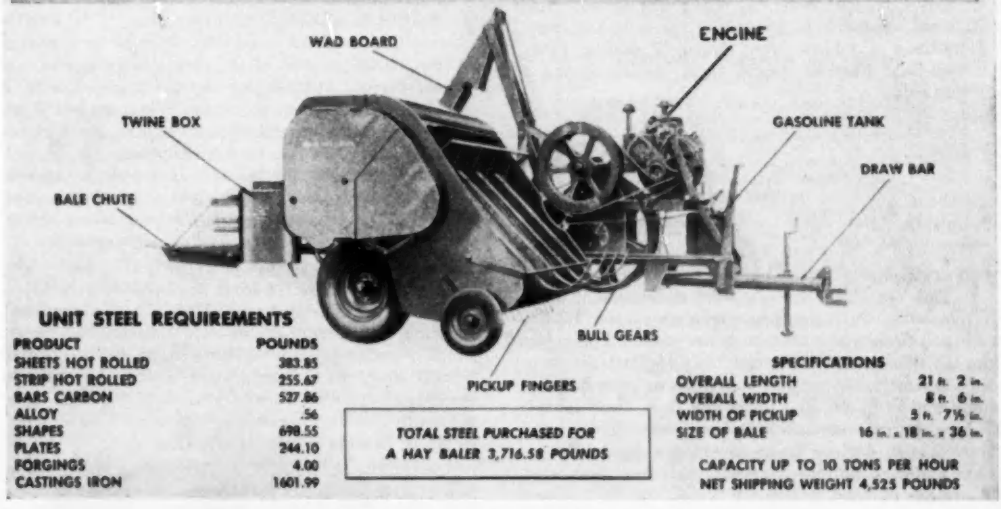
Use of Iron and Steel in a Hay Baler



UNIT STEEL REQUIREMENTS

PRODUCT	POUNDS
SHEETS HOT ROLLED	383.85
STRIP HOT ROLLED	255.67
BARS CARBON	527.86
ALLOY	.56
SHAPES	698.55
PLATES	244.10
FORGINGS	4.00
CASTINGS IRON	1601.99

TOTAL STEEL PURCHASED FOR A HAY BALER 3,716.58 POUNDS

SPECIFICATIONS

OVERALL LENGTH	21 ft. 2 in.
OVERALL WIDTH	8 ft. 6 in.
WIDTH OF PICKUP	5 ft. 7½ in.
SIZE OF BALE	16 in. x 18 in. x 36 in.

CAPACITY UP TO 10 TONS PER HOUR
NET SHIPPING WEIGHT 4,525 POUNDS

This diagram prepared by American Iron and Steel Institute

Influence of Defense Program Discussed by Body Engineers

BECAUSE of the press of defense work and bad weather, attendance at the annual convention of the American Society of Body Engineers in Detroit, November 7, 8, and 9, fell off a little this year. The number of exhibitors, however, remained the same as last year, at 29, and several companies that wanted display space had to be turned down for lack of room.

The three-day program included sessions on styling, body interiors, foreign cars, special purpose bodies, body materials, production engineering, and military bodies.

Among the exhibits the influence of aircraft defense work was in evidence in such products as sealers used as gaskets, adhesive sealers, and patching materials. The materials shortage also showed up in exhibits showing siderails made of secondary magnesium for convertible tops. The magnesium is used because of the scarcity of aluminum.

Exhibitors included American-Bosch Corp., American Metal Products, Anderson Co., Atwood Vacuum Machine Co., Bailey Co., Inc., Bede Products, Inc., Bridgeport Fabrics, Inc., Burlington Mills, Inc., Capitol Engineering Production Co., Creative Industries of Detroit, Detroit Harvester Co., Douglas & Lomason Co., Engineering Reproduction, Inc., Gehringer & Forsyth, Libbey-Owens-Ford Glass Co., Motor Products Corp., Owens-Corning-Fiberglas Corp., Peerless Novelty Co., Presstite Engineering Co., Prestole Corp., Randall Co., Redmond Co., Inc., Shakeproof, Inc., Standard Products Co., Stubnitz-Greene Spring Corp., Tinnerman Products, Inc., Trico Products Corp., United-Carr Fastener Corp., L. A. Young Spring & Wire Corp.

. . . PLASTICS *in the Automotive Industries*

By John G. Slater
Tennessee Eastman Co.

THERMOSETTING type plastics, as you know, have long been used in the electrical systems of automobiles. Such parts as distributor caps, insulators, coil towers, and connectors are essential points of the ignition systems. Interior body applications from time to time would include such items as horn buttons, some control knobs, and pillar and dome light lenses. Thermosetting materials have been considered in connection with various types of exterior hardware designs and cast thermosetting materials have been used in designs of hood ornaments.

Acrylic type plastics have pretty well demonstrated that they have come to stay in the automotive industry. In the lens applications they fought their way in against originally much less expensive glass. The acrylic lenses have demonstrated good abrasion wear, resistance to various automotive cleaning materials and waxes, excellent outdoor weathering properties, and color stability. It is possible to injection mold many complex parts which have a big advantage from a styling point of view, give a good index of refraction and a sharp definition of molded optical prisms, which furnish high candle power output. The toughness of the lenses reduces assembly line breakage.

One of the newest members of the plastics family is nylon. Its unique characteristics have recently resulted in its use for a number of body applications where heat resistance, toughness, and great strength are necessary.

The door striker wedge is an example of an application making use of nylon's high impact strength, excellent abrasive resistance, and ability to operate with a minimum of lubrication to give a quiet, long-lasting door mechanism. Another less known and never seen application is a windshield wiper gear. It is possible to injection mold the gear with finished teeth saving over some 50 per cent of the cost of a gear with machined teeth. Another interesting application is a clutch pedal sealing washer where advantage was taken of nylon's good strength in thin sections, abrasive resistance, and noise dampening characteristics, as well as heat resistance and chemical inertness to gasoline and lubricating oils. The principal accomplishment of this nylon part was permitting a new design which conserves space within the engine compartment.

Possibly the largest use of nylon is in a dome light lens assembly where its flexibility in a "snap-in" type lens was used to permit a one piece reflector and bezel rather than the former separate reflector and bezel, which permits an over-all dome light assembly at a reduced cost. In the application, nylon also had the necessary heat resistance to withstand the light bulb temperature which because of space restriction must be placed in close proximity with the lens.

The critical shortage of rubber during the pre-war year of 1942 resulted in the acceptance of extruded vinyl

(*Turn to page* 60, *please*)

Automotive Industries Management Conference

New England Executives *Confer on* RENEGOTIATION

WITH a representative group of New England executives in attendance, the second of a series of regional conferences on management policies for handling the renegotiation of Defense contracts was held November 12 at Hartford, Conn., under the sponsorship of the editorial department of AUTOMOTIVE INDUSTRIES. The meeting was addressed by Kenneth G. Smith, renegotiation expert, who discussed the latest developments in this field and also the subject matter of the Philadelphia conference, which was reviewed in the October 15 issue (page 46) of AUTOMOTIVE INDUSTRIES. This second conference was off-the-record and featured a lively question-and-answer session in charge of Mr. Smith, who also is renegotiation adviser to AUTOMOTIVE INDUSTRIES. The above photograph shows the group just before the start of the Hartford conference. Additional renegotiation conferences have been scheduled for Buffalo, Cleveland, Cincinnati, Pittsburgh, Detroit, Chicago and other industrial centers.

Guest Executives at Hartford Renegotiation Conference

The Hartford Special Machinery Co., Hartford, Conn.
E. J. Sanderson, Controller
Raymond J. Dunn, Secretary

Waterbury Tool Div., Vickers, Inc., Waterbury, Conn.
M. A. Hayden, General Sales Manager
G. M. Darsch, Assistant Treasurer

Jones & Lamson Machine Co., Springfield, Vt.
William Moeser, Attorney
Norman Harrison, Controller

Pratt & Whitney, Div.

Niles-Bement-Pond Co., West Hartford, Conn.
Walter T. Petry, Financial Accountant
V. L. Howe, Advertising Manager

John Orr Young & Associates, Inc., New York City
John Orr Young, President

Leland-Gifford Co., Worcester, Mass.
Andrew Plantinga, Accountant
George A. Sherwin, Assistant Sales Manager

Kingsbury Machine Tool Corp., Keene, N. H.
Edward J. Kingsbury, Jr., Treasurer
L. A. Carll, Sales Manager

The International Silver Co., Meriden, Conn.
E. F. Dow, Assistant Treasurer

Federal Products Corp., Providence, R. I.
Frederic A. Hien, Assistant Comptroller
Murdoch H. Mac Innes, Secretary

American Bosch Corp., Springfield, Mass.
David K. Tucker, Asst. to the Treasurer
R. C. Farrell, Factory Accountant
Ray Vaughn, Adv. & Sales Promotion Mgr.

The New Britain Machine Co., New Britain, Conn.
R. G. Dowsett, Chief Accountant
Robert J. Smith, Credit Assistant

Hartford Steel Ball Co., Hartford, Conn.
Henry Knust, CPA for Company.

NEW EQUIPMENT • PRODUCTION •

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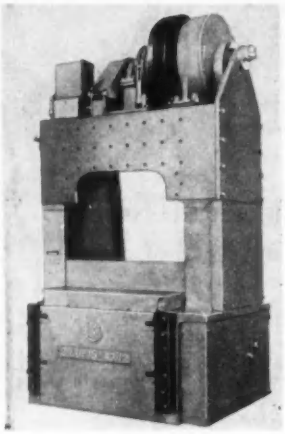
E-87—Gap-Type Welding Press

Development of a gap-frame welding press, in cooperation with a major automotive manufacturer, for use with welding fixtures in the mass production



Bliss gap-type welding press.

of spot welded assemblies has been announced by E. W. Bliss, Canton, Ohio. The gap style frame permits conveyorized feeding from side to side. Work is accessible from either front or back of the press.

The slide is located in the lower portion of the press and the work stroke is upward. Parts to be welded are laid on the lower "die," which contains welding tips, and moved up into contact with the fixed welding tips attached to the upper part of the press. The slide dwells in the upper position, holding the parts in contact with the electrodes until welding is completed.

Pneumatic friction clutch, flywheel and motor are located at the top of the press. The driveshaft is connected by a long eccentric rod to the slide actuating mechanism in the lower part of the press.

Work stroke is adjustable and shut height is the same for all adjustments. Operating cycle is divided into thirds —120 deg for upstroke, 120 deg dwell, 120 deg downstroke. Machine can be started and stopped at any point in the cycle under load.

Slide widths on present models range from 42 in. to 84 in. with 12 in. depth on all widths. Larger or smaller dimensions can be built to order.

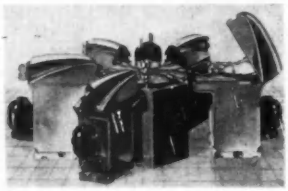
E-88—Polishing Machine

Murray-Way Corp., Birmingham, Mich., has developed an automatic, precision-polishing process which will be known as Micro-Lap. The process and equipment were developed especially for the micro-surfacing of jet engine blades and buckets but has a range of other applications.

Micro-Lap jet blade installations are eight station, hydraulically indexed units. Additional or fewer stations may be had as required. Heads are mounted on floor bases and operate continuously with no pause for indexing. Polishing jaws open automatically to receive and release the work-piece as it makes the cycle.

The indexing table carries only the blade-holding fixtures and the blades being processed.

Successively finer grits under flood lubrication are used to accomplish a



Murray-Way polishing equipment, the Micro-Lap.

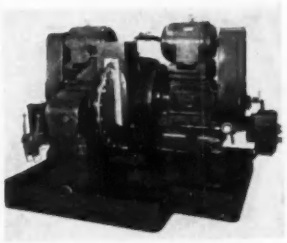
finish of three to four rms in a six second cycle. Cycle time and individual station dwell times are fully adjustable to meet job requirements. Head stroke may also be changed for longer or shorter blade lengths.

In most cases it is possible to microfinish the fillet in the same operation.

E-89—Double Spindle Grinder

Gardner Machine Co., Beloit, Wis., has developed grinding equipment for the finishing of anti-friction bearing roller ends. The double spindle arrangement permits grinding both ends in one operation.

This model 125-26 in. double spindle gardner grinder consists of a heavy



Gardner double spindle grinder model 125-26.

cast iron base supporting heads on dovetailed slides, mounted on ball bearing ways. The heads may be pivoted to the correct angle for best grinding results. Two four in. grinding spindles are mounted in special anti-friction bearings. Each spindle carries a heavy duty abrasive disk.

A rotary attachment mounted on the front of the machine, drives the rotary work carrier at a variable rate of speed within a ratio of three to one. Rotary carriers are interchangeable, permitting a variety of sizes of anti-friction bearing rollers to be ground. Two pairs of micrometer adjusted guides properly locate the work piece while entering between the abrasive disk, as well as while leaving them. The parts are loaded manually; unloaded automatically by a special ejector.

The bearing rollers illustrated measure 1¼ in. diam by 1¾ in. long. Stock removal averages 0.006 in. to 0.0008 in. overall per cut. Two cuts are necessary, each performed at the rate of 18 pieces per min. Tolerances are 0.001 in. for parallelism, and 0.002 in. for squareness and uniformity.

E-90—Transfer Machine

Flywheel housings are machined completely except for disk grinding three faces on a special machine tool recently made by The Cross Co., Detroit, Mich. The machine, a Transfermatic, is able to produce 138 flywheel housings per hour at 100 percent efficiency.

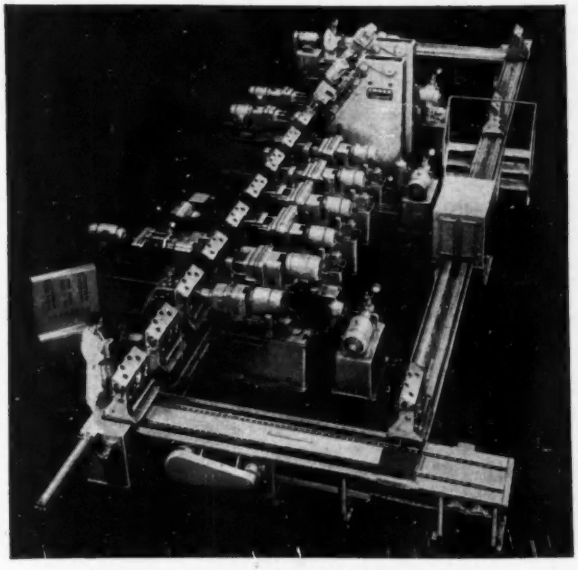
It includes 13 stations—one for loading; one for milling; one for rough boring; six for drilling and chamfering; two for tapping; one for finish boring; and one for unloading.

A special feature of the machine is the use of palletized work-holding fix-

tures which hold the part securely during all operations and during movement between stations. These fixtures are returned to the loading station automatically by an integral conveyor. A cleaning unit automatically removes chips from the fixtures, and a vibrating type conveyor carries the chips way.

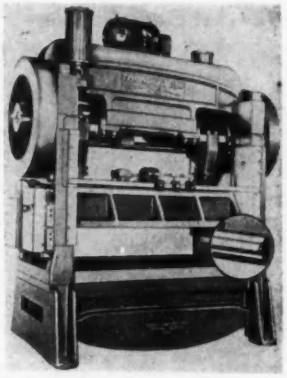
The Transfer-matic is equipped with a Toolometer—a device developed by Cross to control tool life and automatically stop the machine when tools need resharpening. This feature is said to result in less downtime and greater production.

Other features include hardened and ground ways, hydraulic feed, automatic lubrication and construction to J.I.C. standards with stranded wire installation. The machine is composed of standard Cross subassemblies.



Cross Transfer-matic for flywheel housing production.

E-91—Press Line



Designed to blank, draw, form and pierce sheet metal parts, Thunder Bay presses offer a range in capacities from 125 tons to 400 tons. Thunder Bay Mfg. Corp., Alpena, Mich., now offers a new feature—illuminated press beds—which they claim will eliminate die breakage. Fluorescent tubes are placed at each end of the press bed.

Additional features include bed drilled for die cushion installation; ram length equal to bed length; no gib interference, and large gaps in columns for feeding of coil stock from the sides.

(*Turn to page 56, please*)

News of the Machinery Industries

Tool Builders Meeting

Frederick S. Blackall, Jr., president of Taft-Pierce Manufacturing Co., was elected president of the National Machine Tool Builders' Association at its 50th annual meeting in Hot Springs, Va., recently. Swan E. Bergstrom, vice president of Cincinnati Milling Machine Co., was elected first vice president, but granted a leave of absence while he serves as director of the Metalworking Equipment Div., National Production Authority.

Herbert L. Tigges, executive vice president of Baker Brothers, Inc., was elected second vice president and director. Jerome A. Raterman, president of Monarch Machine Tool Co., was reelected treasurer. New directors elected, in addition to Mr. Tigges, were: Ralph S. Howe, executive vice president of New Britain Machine Co., and William A. Dermody, president and general manager of Carlton Machine Tool Co.

Frederick S. Blackhall, Jr., has been elected president of the NMTBA.

Death Blow

The impact of the current machine tool expansion program for defense on the civilian business of the automotive industries was outlined by Swan E. Bergstrom. He drew attention to NPA limitation order M-41 as amended November 8, 1951, and amendment M-41A which became effective Nov. 8. The gist of the death blow to machine tool deliveries against unrated orders is found in Section 3 of M-41 as amended. In essence it states that no new unrated orders can be accepted by machine tool producers for delivery during the freeze period which ends Feb. 1, 1951.

First vice president elect of the Tool Builders is Swan E. Bergstrom.

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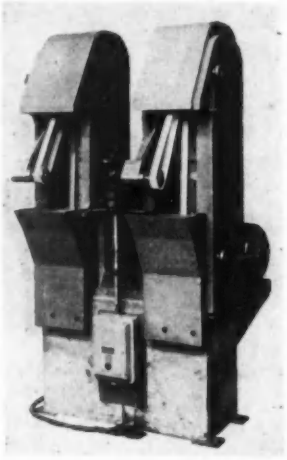
• PRODUCTION • NEW EQUIPMENT • PLANT •

For additional information regarding any of these items, please use coupon on page 66

(Continued from page 55)

E-92—Jet Blade Grinder



This machine for grinding and finishing various types of bucket blades using abrasive or felt belts by the offhand grinding method has been developed by Production Machine Co., Greenfield, Mass. It is equipped with extended housings to mount platen rolls up to four in. wide, and ball bearing spindles for contact wheels up to one in. wide by three in. diam.

The contact wheels are formed to match the contour of various types and forms of blades to be ground or finished. Available in either single or duplex type so that if different grit belts are required the duplex machine may be so equipped.

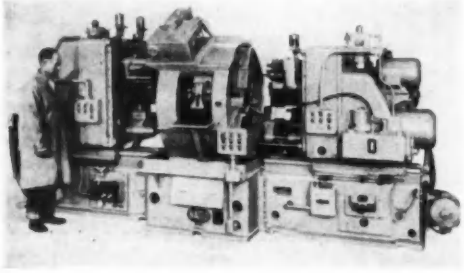
Uses belts up to four in. wide by 115 in. long running at 5000 sfm.

E-93—Automatic Machine

A combination, four-way, horizontal and angular Natco machine drills 10 holes, chamfers four holes, combination reams and spot faces one hole, reams one hole, combination ream and spot faces two bosses and taps eight holes . . . in 85 transmission cases per hr.

Manufactured by the National Automatic Tool Co., Richmond, Ind., the machine consists of horizontal floor type units arranged with fixed center gear driven heads, and provided with auxiliary reversing drive tapping units. These heads contain a total of 17 drilling spindles mounted in anti-friction bearings. There are also eight tapping spindles complete with individual lead screws, floating tap holders and tap lubrication.

One single spindle, reversing, motor-driven, tapping unit is angularly mounted and arranged with hydraulic traverse. One angularly mounted Natco Holeunit equipped with a single spindle drill head completes the machine. It is equipped with hydraulic feed and has an automatic index for the trunnion fixture. One left hand horizontal unit and the angular Holeunit have automatic time delayed reverse and positive stop. Weight of the machine is approximately 15 tons.



Natco combination, four-way, horizontal and angular machine for processing transmission cases.

E-94—Cutting Machine

American Pullmax Co., Inc., has announced the improved 9/32 in. capacity Pullmax machine, Model D-3. This machine has an increased throat clearance for easier inserting and handling of bulky material.

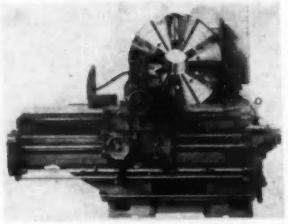
Due to this increase in clearance, the machine is equipped with longer cutting tools. The machine also features quick locking devices on both the circle and straight cutting attachments. Lower guide rail is graduated in inches.

The lower tool holder has been redesigned and improved for simpler setting and adjusting. D-3 model is also capable of beading, folding, slot cutting, nibbling and louvering, simply by changing tools and attachments for the various operations.

All moving parts are enclosed and operate in an oil bath. Throat depth is 48 in. for clearance of large steel sheets. In addition, Pullmax has six other models of their famous machines with cutting capacities of 14 gage up to 11/32 in. in mild steel.

American Pullmax machine, model D-3.

E-95—Right-Angle Lathe Chuck



The illustration shows a Horton 36 in. chuck mounted on a Lodge and Shipley T-Lathe.

The E. Horton & Son Co., Windsor Locks, Conn., has announced a series of chucks designed especially for use on right angle lathes. Developed to meet the requirements of the jet engine manufacturers, this chuck is currently being manufactured in a 36 in. diam size which has a holding capacity from 12 in. to 36 in. Plans have been completed to manufacture this chuck in larger sizes. It is of the scroll combination type in which the jaws can be operated independently, universally or any combination thereof.

It is adaptable for holding distorted pieces which have been stress relieved in their as is position for machining. The master jaws which are flush with the chuck face are T-slotted for attaching various types of clamping or holding devices. This feature makes it possible to use the chuck as a face plate if desired. Hard reversible top jaws or soft blank top jaws are available if specified.

The body is of semi-steel construction and is 5⅝ in. thick. Chucks are available for direct mounting on American Standard spindle noses. All chuck faces have reference lines to aid in setting up.

NEW PRODUCTS

FOR ADDITIONAL INFORMATION regarding any of these items, please use coupon on PAGE 66

F-119—High Intensity Illuminator

An iris-diaphragmmed, high-intensity viewer, that allows study of a wide range of X-ray film densities, is announced by the General Electric Co., X-Ray Dept., Milwaukee, Wis.

The opening can be steplessly dilated or contracted from a ¼-in. triangle to a five-in. diam circle. A special new 100,000 candlepower lamp is used, with an average life of 1000 hr at the rated voltage of 115 v.

Film densities of from 0.5 to 4.5 can be penetrated by the illuminator.

G.E. high intensity illuminator

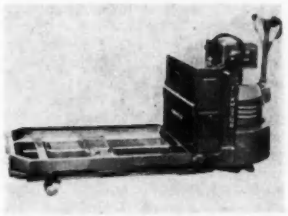
F-120—Resin Core Solder

A highly active resin flux, known as 44 resin, has been announced by Kester Solder Co., Chicago, Ill. Kester "44" Resin is non-corrosive and electrically non-conductive. It conforms with Army-Navy-Air Force Specification MIL-S-6872 (AN-S-62) and U. S. Air Force Specification No. 41065-B-Method 31, also Federal Specification QQ-S-571b.

F-121—Fork-Truck Platform Adapter

A platform adapted for the Towmotor electric pallet truck was recently made available by Towmotor Corp., Cleveland, Ohio. The device converts the model W electric pallet truck into a platform truck and makes possible the handling of platforms, skids and tote boxes.

Constructed of sturdy steel framework, the platform adapter adds extra height to the forks. When not in use, it folds up over the battery and latches securely. The open frame construction permits full visibility for the operator.



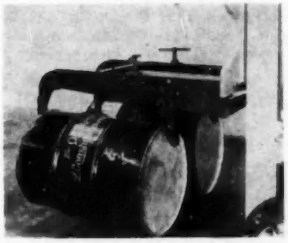
Towmotor platform adapter.

Height of the forks with adapter is 7 in. in the lowered position, 11 in. raised. The platform adapter is available in lengths to match standard pallet truck forks up to 72 in. long.

F-122—Drum Handler

A horizontal drum handling device that can be attached to any industrial fork truck without removing the forks or making any hydraulic or mechanical connections is now available from the Philadelphia Div., Yale & Towne Mfg. Co., Philadelphia, Pa. Completely automatic, the new device is a self-contained unit that fits over the forks and is fixed to them with two screw type clamps.

One or two standard drums can be picked up with the drum handler. The rear clamps are spring loaded and snap under the lip of the drum. When the drums are lifted, gravity action locks the clamping hooks in place.

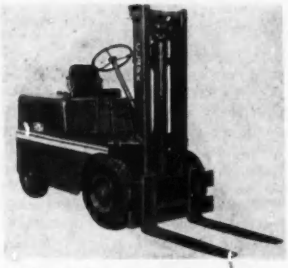


Yale & Towne drum handling device—gravity action locks the clamping hooks in place.

F-123—Diesel-Powered Lift Truck

Diesel power for the Yardlift-40 fork-lift is available from the Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich. The engine, a model DIX-4D by Hercules, has a bore of 3⅝ in. and a stroke of 4 in. Displacement is 166 cu in., giving a brake horsepower of 44 at 1950 rpm. Maximum torque developed is 118 ft lb.

Major specifications, such as 85½ in. turning radius, overall width of 41¾ in., length, etc., remain the same with the new engine as for the present Yardlift 40. The only operating changes will be the ones associated with Diesel operation.



Clark Diesel-powered Yardlift-40.

F-124—Variable Speed Drive

Another size Vari-Speed Motodrive has been announced by Reeves Pulley Co., Columbus, Ind. Designated as model No. 8000, the unit has a capacity of 25 hp and is available in all speed ranges from two to one to six to one. Like other Motodrives, the No. 8000 is a complete, self-contained variable speed power plant. It combines in a single unit the speed-varying mechanism, the user's choice of any standard constant speed motor, and a built-in helical gear reducer, when low output speeds are required.

It is offered in horizontal and vertical designs. Handwheel control is standard, but electrical or completely automatic hydraulic controls are also available. A tachometer, calibrated to the user's specifications, may also be attached.

METALS

(*Continued from page 50*)

selves of a supply. Cutbacks in the brass fabricators' operations because of lack of copper removes these major customers for zinc temporarily from the market and has resulted in another increase in producers stocks, which mounted to over 23,000 tons at the end of October. Domestic mine production of zinc is increasing both in this country and in Canada, with further increases abroad. Consumption of slab zinc in the U. S. in the first six months of 1951 averaged 74,012 tons per month which compares with 80,594 tons in 1950. Undoubtedly more zinc would have been used had it been freely available.

Lead Under Allotment

Government rulings have confused the lead situation to the extent that the metal ranks near copper in being in short supply. It took OPS an unjustifiably long time to adjust ceiling prices for scrap, so as to reflect the two cent increase made for refined lead, although scrap provides about one third of the total lead supplies. In the interim deliveries of scrap have dried up. The worst snafu occurred when OPS ordered that imported lead had to be priced at the domestic ceiling of 19 cents a pound and this in the face of 21½-22 cents for foreign lead at Gulf ports. NAP followed with an order that all foreign lead should come under allotment exactly as for domestic metal. However, execution of this order has been postponed until the first of the year. As a result, domestic consumers have been forced to suspend purchases of foreign lead until prices abroad decline to the OPS ceiling.

Domestic supply of lead has been curtailed by a protracted strike at an important lead smelter which cut about 5000 tons a month from the national output. Labor shortage at the important zinc-lead mines in Idaho has caused a serious decline in production, but this should be relieved as colder weather begins. Thus far in 1951 the average monthly output for the U. S. has been about 33,000 tons compared with nearly 36,000 tons in 1950. It is unlikely that domestic production will increase. Lead is really scarce.

Tin in Stronger Position

The buyers' market in tin may be nearing its end. For over four months RFC has set the price at $1.03 per pound but lower inventories of tin concentrate at the Texas smelter may cause the agency to take a more aggressive buying role. Bolivian tin producers have refused to accept the $1.12 a pound offered by RFC and demanded $1.50. A U. S. mission has gone to Malaya to investigate conditions there in the industry and it is likely that they will recommend a higher price on their return. The London market reflecting world price has been steady at about $1.25. Tin producers have shown more interest and purchases from RCA have been larger.

Aluminum Output Rises

Among the major metals aluminum continues to hold out the best hope for an increased supply and an early end to current shortage. Confirming this was the announcement that the Government would end all stockpiling of aluminum. The expansion program for the metal is proceeding with increased momentum. The present indicated production rate is 850,000 tons a year compared with 726,000 tons pre-Korea. By 1953 the annual production should be 1,360,000 tons and Government officials speak confidently of an even higher output.

Kaiser Aluminum has announced plans for a $100 million expansion, including a doubling of its present 100,000 ton capacity plant at New Orleans. This brings the company's total capacity up to nearly 400,000 tons a year of primary aluminum. Most sensational development was the news that Anaconda Copper Co. proposed to enter the aluminum field and would invest $46 million in a projected 54,000 ton plant in Montana. Speculation is rife why this major copper producer that has spent well over $125 million in expanding its facilities for increased output of the red metal in Chile and in Butte should enter a competitive field for its copper. It recalls the old saying of the veteran politician "If you can't beat 'em, join 'em.

Confusion in Steel

Steel prospects remain confused with sharply conflicting opinions expressed by Government and steel officials. It appears true that if current steel demands were not subject to Government controls, steel output would meet demands, according to officials of Bethlehem Steel and Jones & Laughlin. They are quoted as saying that over -supply of steel is already developing, that the conversion steel marketing is weakening, with a six months falling off of orders for structural steel. Particularly noticeable has been the wide discrepancy between the requests for steel filed with NPA under the Controlled Materials Plan and the fact, according to Bethlehem, that demand for structural steel was fully satisfied by about 40 per cent of the original requests.

Wholly at variance with the above was the assertion of the DPA chief that demand for structural steel was about 200 per cent of available steel and that the present shortage would last at least through 1952. He continued that the earliest improvement in materials allotted for civilian goods would not come until next October.

Steel output set a record in October with 9,086,000 tons, a gain of nine per cent over a year ago. The new high was based on an operating rate of 102.7 per cent of capacity. It is believed that many users of steel pyramided their orders in the third quarter and asked for more metal than they could use fearing that otherwise they might not be able to get adequate supplies if allotments were cut.

The very real danger of a steel strike exists in spite of Mr. Wilson's assertion that it was unthinkable. Bethlehem Steel's chairman has come out in flat opposition to any increase in steel wages which would break the Government's wage formula. Officers of the Steel Union are just as adamant that a substantial wage increase must be granted when negotiations begin in December.

Only one thing appears certain, a compensatory price increase for steel products will be allowed if wages go up. The well-nigh universal belief that another wage increase will be won to avoid a disastrous work stoppage in the vital steel industry, with higher prices ahead, may explain the eagerness of consumers to place orders now in order to get in under the wire.

NEWS OF THE AUTOMOTIVE INDUSTRIES

(*Continued from page 24*)

Defense Dept. Reports On Korean War Cost

Just how costly war is can be seen from a Dept. of Defense report which states that the cost since the outbreak of the Korean war has been $62.9 billion. The breakdown includes $37.3 billion for major military equipment each as planes, tanks, weapons, and ammunition; $4.9 billion for petroleum, clothing, and food; $2.2 billion for construction; and $18.5 billion for military pay and allowances, research and development, and other activities.

Rolls-Royce To Supply Jet Engines to Canada

It has been announced that Rolls-Royce, Ltd., will supply Nene III jet engines to Canada for use in her T-33 jet trainer aircraft poduction. Some of the engines will be shipped from the British firm's plant, while manufacturing facilities will be set up in Canada for others. There are also reports that a projected plant in Montreal, Canada, will be erected primarily to assemble parts of British manufacture.

(*Turn to page 62, please*)

NEW PRODUCTS for AIRCRAFT

FOR ADDITIONAL INFORMATION regarding any of these items, please use coupon on PAGE 66

S-27—Self-Starter

Eclipse-Pioneer Div. of Bendix Aviation Corp., Teterboro, N. J., has developed a self-starter for jet planes. The starter is about the size of a standard typewriter, weighs 75 lb, and develops 380 hp. It is powerful enough to bring large jet engines to starting speed of 2000 rpm or more in 3½ sec after which it automatically cuts out and the engine operates by itself in 10 sec. Bendix engineers state that the starter makes it possible for the first time to star large jet engines with a completely self-contained airborne mechanism.

S-28—Jet Dolly

A "rollover" dolly for assembling jet aircraft engines has been developed by Towsley Trucks, Inc., Cincinnati, Ohio.

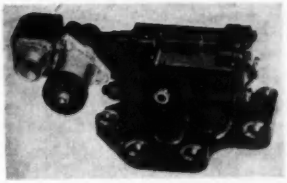
In operation, the engine is mounted in two tubular steel rings which are carried on rollers mounted in the dolly frame, allowing rings and engine to be revolved to any work position. These "rollover rings" can be held rigid in any position by a locking footbrake, operated from either side of the dolly.

Towsley rollover dolly.

Special hold-down clamps on rings prevent upsetting of the engine. Guide brackets can be installed under dolly frame for use with many types of conveyors for moving unit along assembly line.

This jet engine assembly dolly is constructed of tubular steel section frame with rounded corners—an all-steel, all-welded construction. Dolly frame is mounted on four spring-action swivel casters. Floor locks are provided for holding dolly stationary during assembly operations. The dolly is 80 in. long and 36 in. wide overall. The height of the frame from the floor is 15 in. Total weight including two rings is 570 lb.

S-29—Supercharger Control Valve



A blower clutch selector valve for two-speed supercharger control has been developed by Adel Div., General Metals Corp., Burbank, Calif. Some of the features include Power operation by engine oil pressure to high blower position and spring loaded to low blower position.

S-30—Temperature Control System

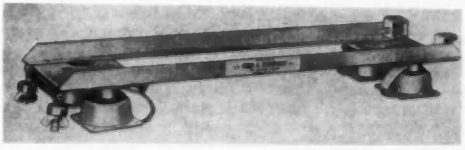
An aircraft temperature control system—Micropulse—has been designed and engineered by the Barber-Colman Co., Rockford, Ill. This system has a proportional pulse duration that automatically matches system response requirements and actuator speeds.

The Micropulse system will control any standard reversible actuator or actuator-valve combination without mechanical or electrical follow-up and without feed-back from the actuator.

S-31—Mounting Bases For Equipment

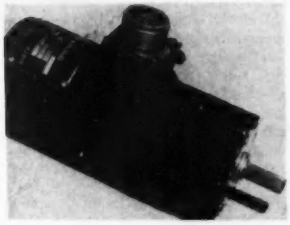
Mounting bases placed on the market by T. R. Finn & Co., Inc., Bronx, N. Y., are designed to protect airborne equipment such as aircraft radios, radar, loran, and similar electronic apparatus. Suitable for military and commercial installations, they exceed Army-Navy E-19 drop test requirements, meet dimensional and metal requirements of Joint Army-Navy C-172A specifications, and have load range of six lb to 80 lb.

The mounting base is carried by four metallic spring-type isolators, which provide protection by maintaining their high vibration isolating efficiency from —80 F to +250 F. "Selective-Action" friction dampening prevents excessive movement at resonant frequencies.



Finnflex mounting bases

S-32—Electrical Actuators



Pacific Airmotive Corp., Burbank, Calif., has announced a series of aircraft electrical actuators. Now in production is the first of a series of special lightweight, high-torque, 24 v d-c actuators. This actuator, weighing less than 1¼ lb., has a maximum torque of 110 in. lb at two rpm. The complete unit includes radio noise filter meeting the MIL-6181 government specification.

S-33—Sideslip Stability Augmenter

Northrop Aircraft, Inc., Hawthorne, Calif., has developed a device known as a sideslip stability augmenter as an approach to problems of aerodynamic stability and control.

Savings in weight and drag are obtainable through use of the device, according to the firm. The sideslip stability augmenter makes use of dynamic rather than static control surfaces to provide stability. It was developed by Northrop's servomechanism group.

The augmenter employs an extremely low threshold accelerometer to measure such special maneuvers as deliberate

(*Turn to page* 104, *please*)

Influence of Defense

Discussed by Body Engineers

(Continued from page 52)

weatherstrip molding for use on army vehicles. The material was well tested in this application and gained considerable acceptance. When the first post-war passenger cars were produced in 1946 this material was used for grommets, nipples, and other applications. Another large increase in its use came on the 1948 models.

It is currently estimated that some three lb of vinyl material are used on each automotive body. Some 12 lb of additional parts might easily be used.

The polystyrene type of material hasn't been too widely used in automotive parts. Certain characteristics have retarded its use. Currently it is satisfactorily being used in some pillar light lenses and previously it was used in certain instrument panel applications, where it was surface coated to reduce the static characteristic and protect the surface.

During the past several years automotive engineers have shown considerable more interest in the fiberglas reinforced material. Much progress has been made in recent years in the production and fabrication techniques which may do much to increase the use of the material. Currently such items as trunk lids, engine hoods, car tops, seat frames, trunk liners, scuff plates, station wagon parts, and others, have been made experimentally.

There is a relatively new group of plastic materials which are copolymers of acrylonitrile and styrene, and acrylic, with the addition in some cases of butadiene. Sheets made from it have excellent formability, can be formed where dinoc transfers are applied, accept paint readily, and generally require low tooling costs. Some possible uses for this type of material might include: fender and stone guards, door liner panels, sun visors, instrument panel parts, inside trim for station wagons, scuff plates, and seat backs.

. . . MILITARY DUMP BODIES

By J. M. Gwinn, Jr.
Gar Wood Industries, Inc.

MILITARY dump bodies generally are not loaded under large shovels. Their service more nearly parallels heavy duty contractor's body service. It is apparent that commercial experience is, that whatever cross ridges may appear in the floor due to the body sagging between cross members has not interfered with dumping sufficiently to create any demand for a different design.

It has been frequently proposed that since the dump body has sides these sides should take the longitudinal bending. This presumably would eliminate the body longitudinals. In fact, several such commercial bodies are or have been in limited production.

Excepting in special situations, however, stress analysis shows that the added cross member weight to carry the floor load out to the body sides and to carry the hoist and hinge loads also out to the sides, substantially exceeds the weight saved by eliminating the longitudinals.

Actually the longitudinals need not go all of the way to the front of the body. But with normal flat top truck frames, a spacer would be required in place of the longitudinal and again little weight would be saved. More labor would be required because the number of kinds of pieces would be increased.

Local yield has been mentioned as having the least damaging effect on the body. This is true for isolated loads and where there is no later load reversal. With reversible loads, stresses must be held within the fatigue limits.

Floor and cross members can take permanent set without great harm. Hold down attachments and supports for spare tires and other fixed masses must operate under the fatigue limits of the material.

Handling and collisions frequently damage bodies. Body design should provide that such damage is local, i.e., the local strength against impact must be less than the overall body strength.

Running boards should be capable of buckling locally without distorting the body as a whole.

Body sides should dent locally under shovel impact loads. This is another reason why the use of body sides to take longitudinal bending is not recommended for dump bodies. A buckling of the body side upper flange will tend to weaken the body under bending loads for hoisting.

A few basic criteria of military dump body design are as follows:

1. The body must support the useful load under operating conditions.

2. Road shock must produce no destructive fatigue failures.

3. Impact from dropping loads into the body should be absorbed by harmless local yielding.

4. Bodies must be capable of distorting elastically with the vehicle at stresses less than the fatigue limit.

5. The body should resist a reasonable amount of handling and collision loads by local yielding.

. . . AUTOMOTIVE FINISHES

By D. B. Killian
E. I. du Pont de Nemours & Co.

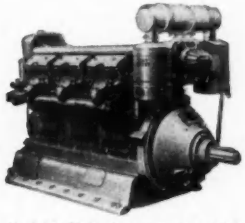
THE most important prime white pigment in the formulation of automotive finishes is titanium dioxide. Titanium white is the "whitest" white pigment with outstanding opacity and covering power. Until about 10 years ago titanium dioxide was commonly available only in the crystal form known as anatase, which type had the serious disadvantage of early and free chalking when exposed to weathering in a surface coating. With the introduction of rutile titanium dioxide, this disadvantage has been overcome since certain forms of surface treated rutile titanium dioxide are very resistant to chalking on weathering in a surface coating. Rutile titanium pigment has enabled the successful formulation of a whole range of tinted body finishes which return satisfactory performance in gloss retention, chalk resistance, and durability. Titanium dioxide of this improved quality is of growing importance today with the trend towards pastel finishes. Of course, satisfactory performance of these tints also depends upon tinting colors of adequate lightfastness and color intensity. Titanium dioxide is suitable only for solid shade tints, that is, color effects depending upon high opacity and tinting strength of the white pigment.

Transparent tint effects are produced by the so called metallization of finishes. Metallized finishes are formulated by adding to the vehicle-color pigment system finely divided aluminum flakes which produce a highly attractive two-tone transparent effect. Although standard metallized finishes contain only 5 to 10 per cent aluminum by weight of the pigments in the finish, yet this type of extension of a pigment color has been found to be more severe in accentuating the fading tendencies of a color than much more highly extended titanium dioxide tints. Consequently pigment colors suitable for metallization must possess the very highest degree of light-fastness attainable, as well as transparency and tinctorial intensity.

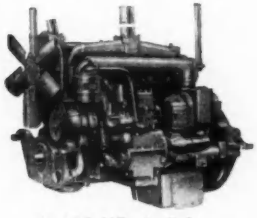
Many metallized finishes are formulated with a transparent hydrated iron oxide as base pigment to which is added one or more tinting colors and aluminum flake. The effects obtained by such combinations are very attractive and unusual, the color tone ranging from golden tans through browns, maroons, blues, greens and grays depending on tinting colors used. The hydrous ferric oxide acts not only as a colorant in the finish but appears also to contribute to improved film durability. The excellent color stability and general chemical inertness of ferric hydrate has rapidly increased its use in lacquers as well as alkyds.

SOME *Famous* ENGINES EQUIPPED WITH SCHWITZER-CUMMINS SUPERCHARGERS

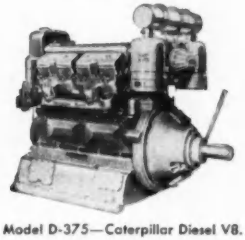
Model 487-C—Harnischfeger Corporation 6 cylinder, 2 cycle using two S-C superchargers.



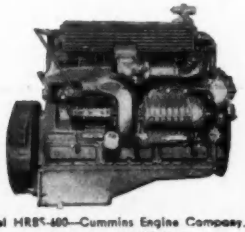
Model D-397—Caterpillar Industrial Diesel V-12.



Model D-337—6 cylinder—Caterpillar Diesel.



Model D-375—Caterpillar Diesel V8.



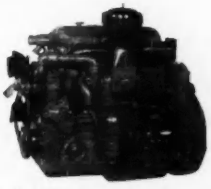
Model HRBS-600—Cummins Engine Company, Inc. (Used also on HBS Series)

More than twenty-five years of research, intensive engineering, wide field experience and unexcelled manufacturing facilities are back of our product.

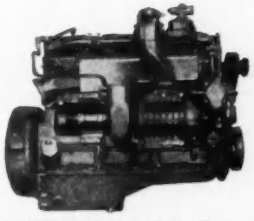
Its excellent service record in tens of thousands of applications under the most severe operating conditions has established Schwitzer-Cummins superchargers as a product of supreme reliability and efficiency.

We build superchargers for trucks, busses, earth-moving equipment, power plants, submarines, in fact for all uses up to 800 hp.

We can offer the last word in engineering assistance and the ability to produce efficiently.



Model 487-C—Harnischfeger Corporation 4 cylinder, 2 cycle.



Model NHRBS-600—Cummins Engine Company, Inc. (Used also on NHS-NHBS-NHBRS.)

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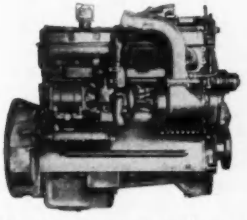

Model JBS-600—Cummins Engine Company, Inc. New High Speed Engine.

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News of the Machinery Industries

(*Continued from page* 55)

Mr. Bergstrom indicated that unrated orders, for delivery to the automotive producers, now on the books still can be delivered to the customers, provided delivery can be made before the deadline of Feb. 1. That is to say, if materials and parts are available so machines can be completed, delivery can be made legally within the meaning of the act. On the other hand, NPA is exercising its power to make diversions, and diversions are being made of many machine tools now under construction.

Speaking of diversions, it is obvious that diversions apply primarily to general purpose tools and may not affect delivery of special machines and transfer machines, although the risk is always present.

The reason for this drastic order, as explained by Mr. Bergstrom, stems from the fact that the machine tool industry now has a backlog of orders amounting to $1.3-billion, representing over 23 months of production at the rate prevailing in September, 1951. By July 1, 1952, it is estimated that an additional $1.5-billion of orders will have been accrued. The magnitude of this job is so enormous as to require a vast increase in manufacturing facilities together with subcontracting of upwards of 30 per cent. This will be accompanied by a drying up of the volume of unrated orders that can be accepted for the civilian economy.

European Tools

K. T. Kuck, The Monarch Machine Tool Co., reported on the first European Machine Tool Show, held in Paris last September. More than 800 exhibitors displayed something over 2000 machine tools. In general, this show indicated that European machine tool builders have come up with some excellent machines of good design and fine finish, including outstanding examples of transfer equipment. It points up the fact that ECA funds did a good job of building up the foreign machine tool industry, albeit at the expense of our own industry in the future. In fact our domestic machine tool industry may have a difficult task in regaining some of its traditional export business when the defense program has been completed.

In 1952 the British will hold a machine tool exhibition at Olympia in September. Despite this, another European show has been scheduled at Hanover during the same period.

Joel Barlow warned manufacturers of the implications of the 1951 Renegotiation Act which differs considerably from the ground rules during WW II. In his opinion it is intended as a recapture of profits pure and simple. Too it will be administered by a civilian board, primarily of lawyers, rather than by military boards.

Shortages of materials and the need for substitutions in steels have become as much of a problem for machine tool builders as it has been for automotive producers, according to A. H. D'Arcambal, vice president, Pratt & Whitney. He outlined the necessity for studying the adoption of boron steels, using the data which have been accumulated by the automotive industries and AISI.

AIEE Tool Conference

Over 400 electrical engineers gathered together for the American Institute of Electrical Engineers' Fourth Annual Conference on Machine Tools in Rockford, Ill., last month. This turnout was by far the largest ever obtained by the institute for a machine tool meeting.

Users, builders, and equipment suppliers of machine tools were well represented and their views on electrical equipment were heard with interest. Papers presented brought to light the most modern methods of machine tool electrification.

The users who presented papers were from the automotive industries. In all there were 11 papers presented which were followed by much discussion.

Faulty Tools

R. W. Kowitz of Ford Motor Co. gave a report on the background of JIC standards and their value to the automotive industries. He cited case examples where machine tools currently received from WW II storage and marked "ready-to-operate" were faulty in most instances. These machines had been built before JIC standards went into effect.

New Developments

A new series of electric brakes and clutches for use on industrial machinery was announced by Paul Harter, chief project engineer, Warner Electric Brake & Clutch Co.

Among the developments are a combination clutch and brake for use on electric motors; a positive acting dead man control which instantly stops the machine should trouble develop; and an electric clutch which ranges in size from 1½ to 15 in.

A paper on electrical resistance strain gage studies of dynamic loads in machine tools, presented by D. Schaeve and J. A. Sweeney, Barber-Colman Co., emphasized the important part that electric strain gages have played in the development and improvement of machine tools.

Plants Visited

One of the features during the course of the meeting was the plant tours of several Rockford Machine tool companies—Barber-Colman, Barnes Drills, Greenlee Bros., Ingersoll Milling, Mattison Machine, Rockford Machine, Rockford Ordnance Plant (operated by W. F. & John Barnes Co.), and Sundstrand Machine.

Conveyor Tools

G. Walter Ostrand, general manager, Caldwell Plant, Link-Belt Co., was elected president of the Conveyor Equipment Manufacturers Association at the association's annual meeting at The Homestead, Hot Springs, Va., recently. He succeeds L. B. McKnight, executive vice president, Chain Belt Co.

R. C. Sollenberger, who has been the staff head of the association since 1945, was re-elected executive vice president. Other officers are: Harry C. Davis, general manager and chairman of the board, Kanawha Manufacturing Co., vice president; R. F. Tomlinson, general sales manager, A. B. Farquhar Co., treasurer; and Lee Sekulski, sales manager, Mathews Conveyor Co., secretary for a second term.

The following were elected to the executive committe: J. E. Jeffrey, vice president, Jeffrey Manufacturing Co.; J. E. McBride, vice president, Palmer-Bee Co., and Mr. McKnight.

AUTOMOTIVE NEWS

(*Continued from page* 58)

Pittsburgh Gear Co. Purchased by Brad Foote Gear Works

Brad Foote Gear Works, Inc., recently announced the purchase of the Pittsburgh Gear Co., Pittsburgh, Pa. While financial details of the transaction were not disclosed, it was stated that ultimately the acquisition of the Pittsburgh firm would add about $2 million annually to Brad Foote's peacetime volume.

Gould Building New Plant in Canada

The Gould Storage Battery Co., Ltd., Canadian subsidiary of Gould-National Batteries, Inc., is building a new $250,000 plant in Ft. Erie, Ont., for the manufacture of batteries. The one-story structure will contain about 30,000 sq ft and is scheduled to go into production early in 1942.

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Chrysler Looks Ahead

(*Continued from page 34*)

torque ratio of 2.7, which is higher than any passenger car automatic transmission currently in use. Particular emphasis has been put on reducing weight and the number of parts with the result that the unit is up to 56 lb lighter and has 42 per cent fewer major parts than competitive automatic transmissions. One reason for its light weight is use of an aluminum die cast converter housing. For the more immediate future Chrysler has developed another transmission similar to the Fluid-Torque drive but with oil for the converter supplied by the engine oil system rather than from an independent supply within the converter itself.

Experimental Electromagnetic Transmission

Another field of transmission exploration being carried on by Chrysler is the electromagnetic type. On display was a three-speed, fully-automatic power shifting unit involving a planetary gear system engaged by clutches activated by electromagnets. The unit provides full engine braking, has no creep at engine idling speeds, permits push starts, and involves no cooling problems, since no oil or other liquid is required for transmission of torque. It still is in the experimental stage, however, with no immediate plans for its adoption.

Several exhibits dealt with the intensive drive being made by Chrysler to find alternate materials to replace those that have become critically scarce and to reduce material costs through better design. A new carburetor has been developed that is considerably smaller than the current model, is simpler in design, and can be manufactured of zinc, aluminum, or magnesium. The present zinc carburetor weighs 7¼ lb and is 5⅛ in. high. The new model in zinc weighs 3¾ lb and is 4¾ in. high. Made of aluminum its weight is 2¼ lb and with magnesium only 1¾ lb.

Of particular interest in the production field was the display of magnesium die castings 13 of which are already in production and with two more slated to be adopted soon. The 15 castings will replace castings weighing 100 lb with a saving of 75 lb in weight. Some of the castings are fairly large such as a torque converter housing and clutch housing. Other smaller castings include steering column shroud, a pillar for the convertible top, oil filter body, oil pump body and cover, and an instrument panel cover and cluster ring.

Valves by Shell Molding

Another development still in the experimental stage and included in the exhibit was the shell mold process for producing engine valves. The process uses fewer operations prior to finished machining than the forging method.

Savings of critical metals may be made possible through a reduction in the length of the heater tube used to actuate the automatic choke. The tube is made of Inconel. Currently the tube extends inside the cast iron manifold, but in the experimental development the tube attaches to the manifold, which has enlarged cast-in cavities which provide a heat reservoir. An alternate method under study is to use a bolted-in choke heater at one end of the manifold but this is not as desirable as it would require some extra machining. With either method, the length of Inconel tubing is reduced by about one half.

A sizeable reduction in the number of parts in the pump of the power steering unit also is being effected. Considerable savings in both cost and weight result from elimination of 15 parts with several others redesigned to simplify manufacturing.

Another exhibit of considerable interest shows a new experimental flat type hydraulic valve tappet which is scheduled to be used in the new DeSoto engine. The design eliminates the ball check valve and requires one less piece.

Less Copper in Radiators

Chrysler, like other companies, has been giving a lot of attention to reducing the amount of copper used and also to find a substitute for copper in radiators. It already has cut the amount of copper used in radiators by 23 per cent, by reducing the gage thickness of the tank, water courses, and core spacers. An aluminum radiator has been under test for several thousand miles, but some knotty problems still have to be licked before it can be considered for production use.

Chrysler already is using some applications of vaporized metal on plastic parts which formerly were chrome-plated zinc die castings. One application involves using a one-piece clear plastic lens for accessory lights, with the outer rim coated on the underside with vaporized aluminum, in place of the two piece glass lens and metal bezel combination. Initial tests indicate that the clear plastic may be more permanent than the chrome zinc parts, particularly in resistance to salt corrosion. In addition, they are much lighter in weight and cost less. Plastic also is replacing metal parts such as the water pump impeller, ash receivers, battery trays, and stop and tail light connecting tubes. They are less fragile for these applications and provide better insulation, in some cases eliminate brass or synthetic rubber parts, and are easier to assemble.

Several exhibits dealt with experimental projects in the ignition and lighting field. A new type phenolic resin experimental distributor cap has much higher resistance to arcing damage than types currently in use. Another interesting project is an experimental high-frequency, dual-coil ignition system. It includes the addition of a discharge gap and condenser at the input to the distributor and a step-up transformer in the spark plug connector. The result is a resonant circuit which gives a high frequency discharge at the plug. Another project under development involves replacing the conventional single circuit breaker in the lighting system with three circuit breakers inside the light switch.

Chrysler engineers also are working on new methods of sealing windows and windshields. Current practice on windshields and rear windows is to use a two piece strip with a locking bead. A new design has been developed with one-piece construction in which the locking strip is integral. Also under development, to replace the outside, inside, and glass channel seals, is a one-piece unit which seals the window both outside and inside as well as the glass in the channel.

Also demonstrated at the display were four types of experimental brake drums designed for forced air cooling. They are cast aluminum with integral straight fins, cast aluminum with integral curved fins, cast iron with compression bonded fins, and cast iron with integral straight fins.

Materials Handling at Ford

(*Continued from page 39*)

operation. Quenching is done in oil.

Springs then roll down a chute onto a slat conveyor carrying them through an extended oil tank, then onto another slat conveyor through the draw furnace where they are drawn at 800-820 F for 72 minutes. Springs drop off the automatic furnace conveyor into the cooling water tank and are removed by hand, using a steel hook.

Next they are shot-peened in American Wheelabrators, conveyed and transferred onto hooks on the paint conveyor where they are submerged in paint, carried over a drip pan, then travel through a baking oven. Baking is done at a temperature of 450 F for 45 minutes.

Remaining operations include—automatic bulldozing to develop the initial preset, checking calibration by weighing machines, marking, and finally loading onto pallets for shipment to assembly plants.

Speaking of Preference... 21 of 25 Leading Engine Manufacturers Using Chrome Rings Specify PERFECT CIRCLES

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D-168 Broaching Machines

Colonial Broach Co.—A four-page technical bulletin, #HS-51, describing an improved line of four to 15 ton capacity horizontal broaching machines, is available.

D-169 Rotoblast

The Pangborn Corp.—Announced is a four-page, brochure on the firm's airless Rotoblast room.

D-170 Hand Trucks

Yale & Towne Mfg. Co.—A 16 page bulletin, P809, describing the application, types and operation features of the Yale line of motorized hand trucks and electric stackers has been released.

D-171 Hot Spraying

Arco Co.—Available is a 20-page booklet describing a new, integrated system for hot spray application of product-finishing lacquers and enamels.

D-172 Handling Equipment

Link-Belt Co.—A 44-page book, No. 2410, on coal and ash handling equipment for power plants, has been published.

D-173 Bonding

National Brake Block Corp.—An eight-page booklet on the procedure of bonding brake linings is available.

D-174 Metal Cutting

E. F. Houghton & Co.—"Getting Down to Cases on Metal Cutting" is the title of a 32-page book recently compiled.

D-175 Machine Tool Lubrication

U. S. Dept. of Commerce—To help lengthen the life of machine tools, the Office of Small Business, National Production Authority, has issued a pamphlet on lubrication materials and methods.

D-176 Induction Heating

General Electric Co.—A 12-page bulletin on equipment for induction heating has been announced as available.

D-177 Copying Machine

Charles Bruning Co., Inc.—Booklet, A-2009, describes a new Copyflex machine which is being introduced to business and industry.

D-178 Wet Blasting

American Wheelabrator and Equipment Corp.—A machine for wet abrasive blasting is described in a four-page bulletin just published.

D-179 Grinding

Landis Tool Co.—"Better Grinding" is the title of an 84 page book, which has just been released.

D-180 Gas Atmospheres

Surface Combustion Corp.—An illustrated bulletin on industrial applications of gas chemistry for heat treating has just been released.

D-181 Equipment Line

The Sheffield Corp.—Catalog TFG 13579-51 covering the Sheffield line of precision thread and form grinders has just been issued.

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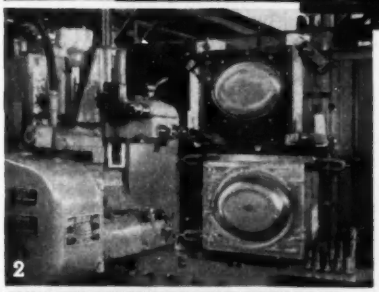

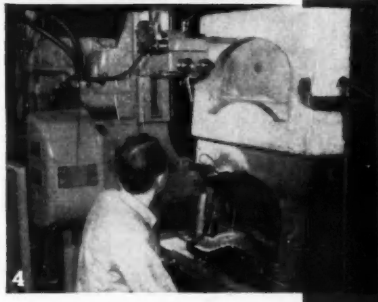

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Three National SAE Meetings

(*Continued from page* 43)

its full performance speed varies between 1750 and 2100 rpm. The horsepower at maximum engine speed, just before an upshift, is 208. The horsepower right after the upshift, assuming no loss of vehicle speed during the shifting, is 189. Assuming equal efficiency of the two gear trains, there would be a loss of tractive effort, after the shift, of nine per cent.

This, in an automatic transmission would probably hunt occasionally, but might be considered a minimum acceptable limit. It means, then, 10 gear shifts of 1.2 to one reduction to cover the six to one high performance drive range automatically, with an engine of this characteristic.

The mechanical complication of both the gear train and the automatic control of this sort is somewhat discouraging. The problem would be a lot easier if the engine characteristics were more nearly like the passenger car engines.

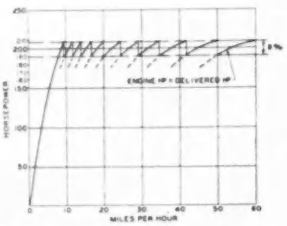

Fig. 1—Typical heavy-duty engine with a mechanical drive—1.2 gear change.

Fig. 2 shows a typical semi-high-speed engine. It has a maximum horsepower of 125 and can be run to 3650 rpm where its horsepower has fallen off to 120. If an upshift of 1.57 to 1 ratio is made at this engine speed, it will result in the new engine speed of 2325 rpm. The horsepower at this speed is 109—which is nine per cent less than 120. In other words, this engine could be shifted through 1.57 reduction as compared to the typical heavy duty engine's 1.2 reduction, with no more than the same nine per cent loss of performance after the upshift. A five speed transmission of equal steps

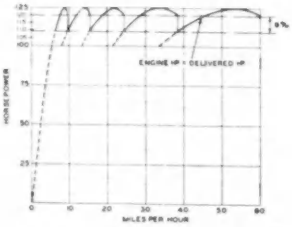

Fig. 2—Typical semi-high speed engine with a mechanical drive—1.57 gear change.

of 1.57 would now cover the six to one driving range, and require only four automatic shifts instead of 10.

This points out the fundamental relationship of the transmission to the engine when automatic maximum performance is desired without the danger of hunting. If the transmission is of the gear-shifting type, it must be matched to the engine to prevent hunting in automatic operation.

There seems little doubt about the way to get the highest transmission efficiency. Straight mechanical drive, or high efficiency fluid coupling driving through gears, produces the high-

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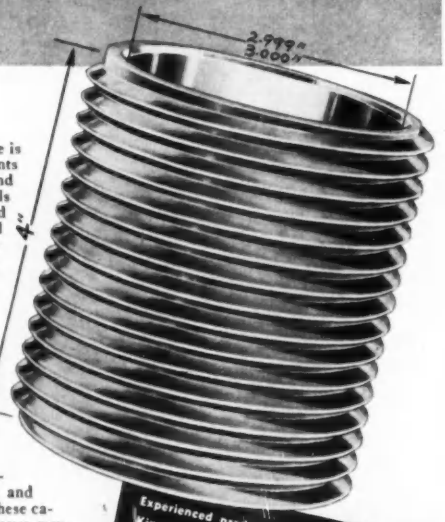

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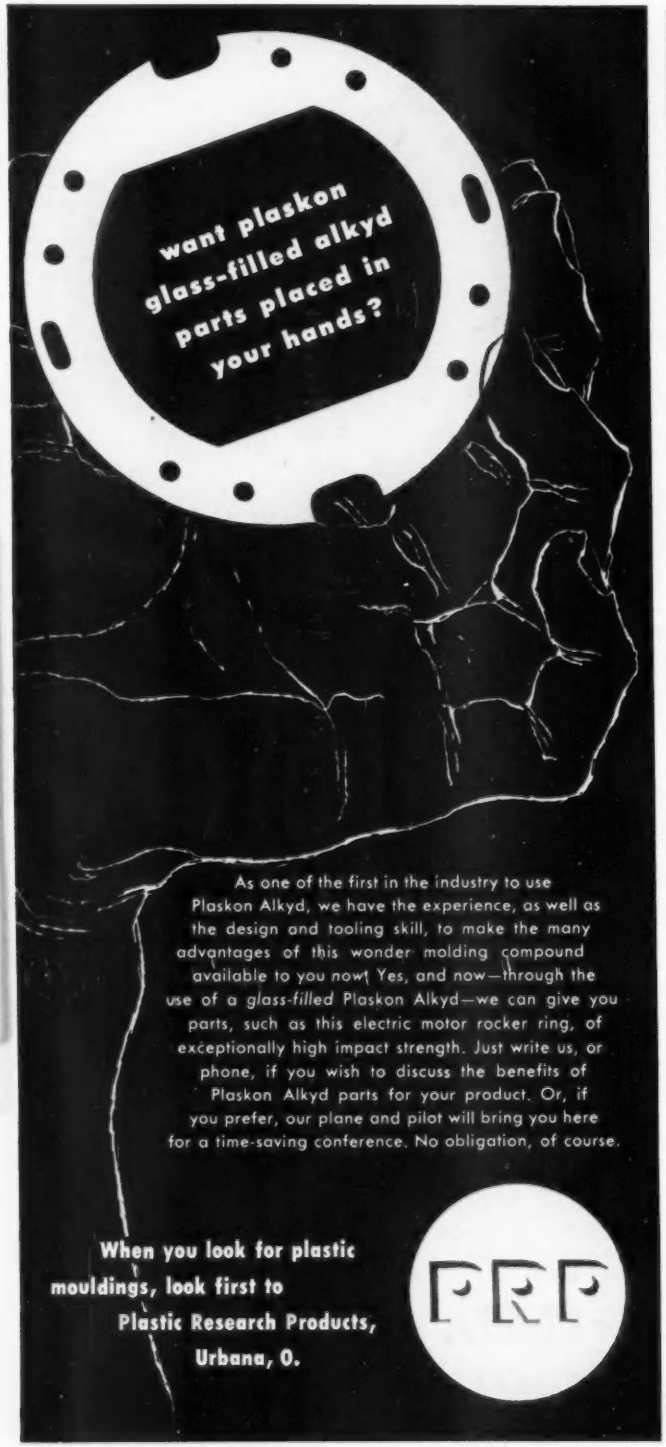
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est transmission efficiency. When a torque converter is used, its efficiency slides off the optimum fluid coupling's efficiency in proportion to the amount of torque multiplication. This is true, whether a rather mild converter is used or a stronger converter in some split torque arrangement is chosen. The re-

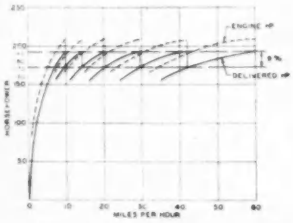


Fig. 3—Typical heavy-duty engine with a mild converter drive and 1.43 gear change.

sults are the same. The more the variable hydro-dynamic drive is asked to do to eliminate gear steps, the more will the efficiency suffer.

If a mild converter with high top end efficiency is used in combination with gear shifting under the same ground rules of no more than nine per cent loss of tractive effort after an upshift, there is, again, a similar engine relationship in the picture, but somewhat less pronounced than with straight mechanical drive ratio transmission. Fig. 3 illustrates the relationship of the heavy duty engine to a torque converter transmission. The engine has reached a speed of 2100 rpm at the upshift and the torque converter has just come to one to one torque ratio at 92 per cent efficiency. The input horsepower is 208 and the transmission output horsepower is 191.5. After an upshift of 1.4 gear ratio, the input speed will be 1820 and the torque converter will have almost 2 torque multiplication at 91.5 per cent efficiency. The input horsepower is 190 and the transmission output horsepower is 173.5. This represents a loss of tractive effort of nine per cent after the upshift and qualifies for anti-hunt considerations as well as the

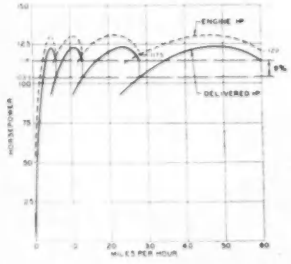
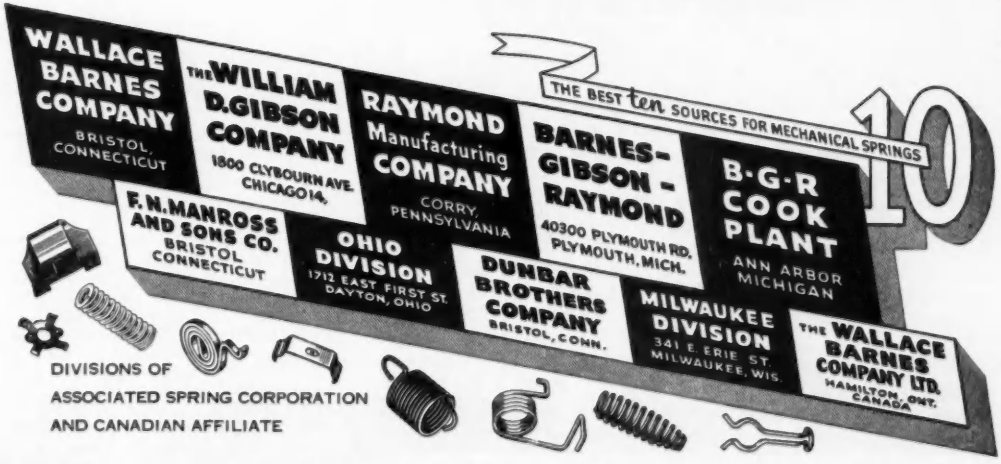


Fig. 4—Typical semi-high speed engine with a mild converter drive and 2.14 gear change.

38 factory-trained field men in constant circulation



mechanical drive's 1.2 ratio changing.

Five shifts of 1.43 gear ratios will cover the necessary six to one driving range in place of the ten required in the mechanical drive transmission. The average torque converter efficiency for this drive range is 92 per cent which represents a loss of both efficiency and performance of eight per cent.

Fig. 4 shows the application of the same converter to the semi-high speed engine, using a 2.14 gear change. At the upshift point the engine speed is again 3550, engine horsepower is 120 and the converter efficiency, running well in the coupling range, is 95 per cent. Output horsepower is 95 per cent of 120 or 114. After the upshift the engine speed is down to 2130, delivering 117.5 hp. The converter is delivering torque multiplication of slightly over 1.3 at 88.5 per cent efficiency, resulting in delivered horsepower of 103.5—which is again nine per cent less than before the upshift.

With this four speed arrangement, three shifts of 2.14 cover a range of about 10 to one at high efficiency—and the converter's additional multiplication at lower speeds would supply the total range requirements, adequate for any highway truck requirements. In the top 10 to one range the average converter efficiency would be approximately 93 per cent representing a seven per cent efficiency loss, but due to somewhat higher average engine speed, the performance loss would be approximately six per cent.

More Powerful Engines for Trucks

By J. E. Glidewell
Hall-Scott Motor Div.,
ACF-Brill Motors Co.

ONE great advantage in having increased power in trucks, especially on long hauls, is to reduce running time. Trucks are limited, or should be, to maximum legal road speeds and the nearer the minimum speeds can be held to the allowable limit at all times, the better the running time. This means more power in engines. There is also the further obvious condition that the larger the load that can be carried, the lower the transportation cost per pound, other things being equal, since only one driver is to be paid in any case.

In line with this general trend, the output of large truck engines has been on the increase for sometime. There are now available several Diesel engines exceeding 250 hp and in one case at least having an output of about 500 hp. A Hall-Scott 400 engine as equipped to burn gasoline has been on the road for some years. The LPG fuel version of this engine has also been in use for some 12 years. The Model 400 is 5¾ bore by seven in. stroke having six-cyl giving a displacement of 1091 cu in.

Continuing the Hall-Scott policy of giving big truck users the additional power they require, the 400 series engine is being released with bare engine output of about 335 hp instead of 285 as formerly built. This been been accomplished by increase of comparession ratio from 5.7 to 6.4, new improved combustion chamber and intake manifolding. Fig. 1 shows power, torque, bmep and specific fuel consumption for the 400 engine as compared with the new revised version to which the model Number 401 has been assigned. The top governed speed has also been increased from 2000 to 2200 rpm in order to improve flexibility of operation. The fuel used was 76 octane in both cases. An appreciable gain in output is shown, especially in the upper speed range. A considerable improvement in specific fuel consumption is also shown, both tests being made at an air fuel ratio of approximately 14 to one.

The 400 series is also produced with six in. stroke making cylinder size of 5¾ by six and total displacement of 935 cu in. This engine being shorter stroke is governed at 2400 rpm.

The change in combustion chamber is shown diagrammatically in Fig 2. The contour of the chamber was revised from the dotted lines to approximately a figure eight shape as shown in full lines. This chamber is not claimed to

(*Turn to page 76, please*)

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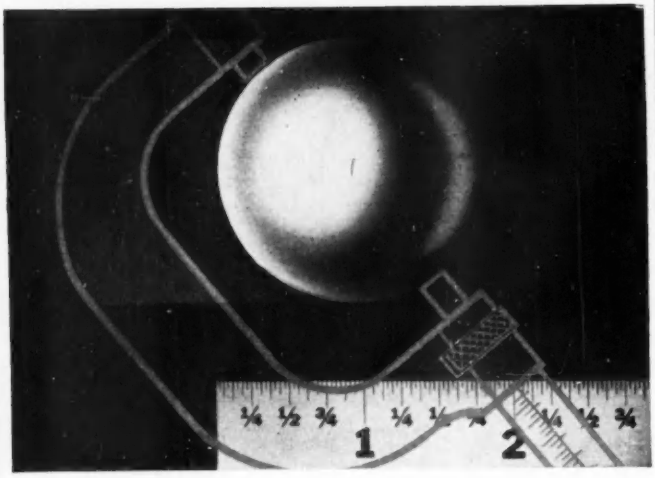

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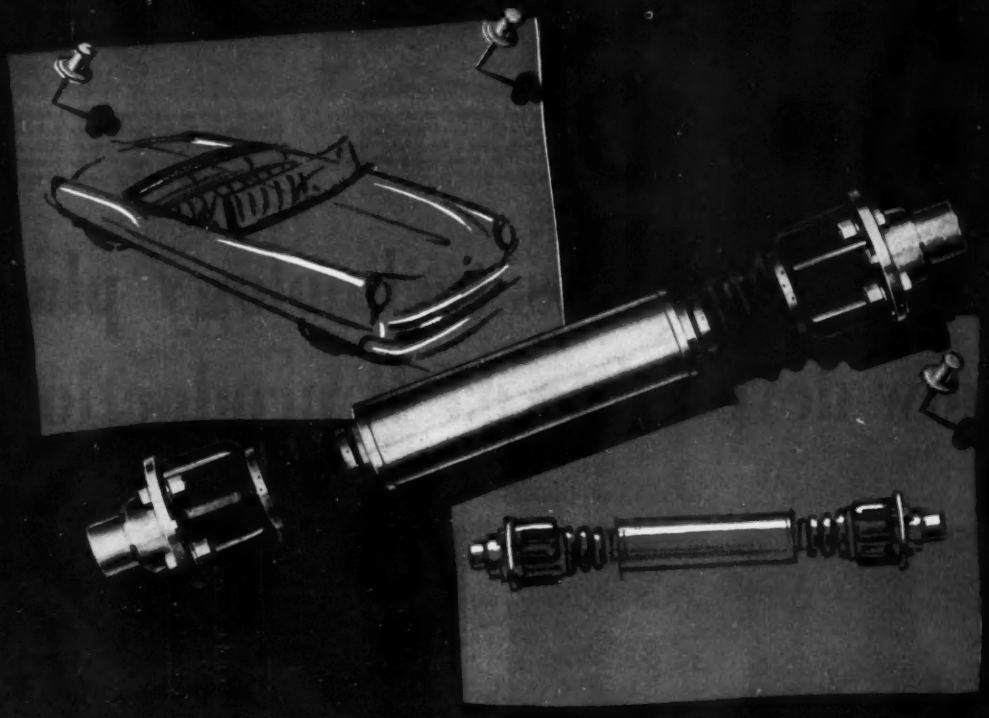


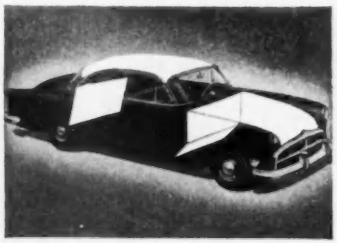
Detroit's Exclusive Anti-Friction Slip Motion Assures a Better Riding Car

Increased speed and torque of high compression engines place additional burdens on universal joints. DETROIT Universals are keeping pace with these requirements.

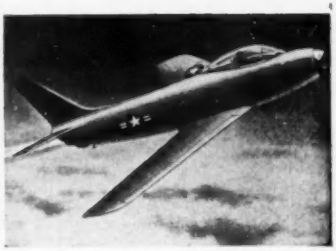
Detroit UNIVERSAL JOINTS

UNIVERSAL PRODUCTS COMPANY, Inc., Dearborn, Michigan

Automobile tops, insulated with L·O·F Fiber·Glass against heat and cold, increase passenger comfort. Easy installation. Light weight. Won't deteriorate under normal conditions.

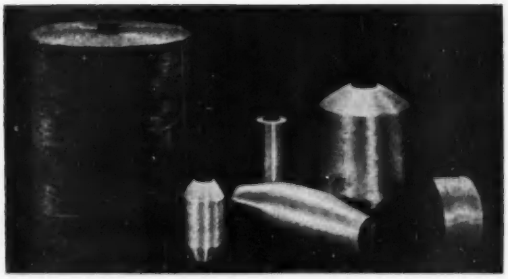


Automobile sound insulation a made-to-order job for L·O·F Fiber·Glass. Easy installation in doors, under the dash, on the fire wall, under the hood. Low moisture absorption, light weight.

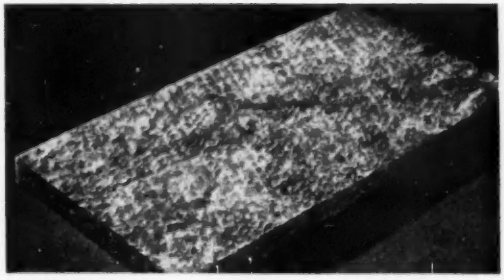


Aircraft sound and thermal insulation. Get these advantages of L·O·F Fiber·Glass. Light weight (as low as .3 lb. per cu. ft.). High fire safety. Low moisture pickup. High sound-insulating efficiency.

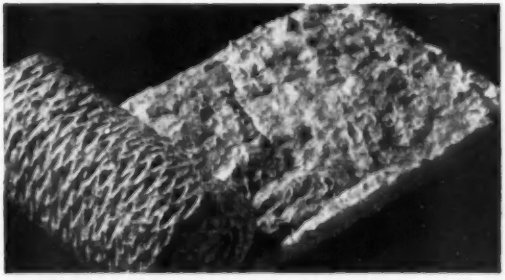
Proven glass technology plus now devoted to early production



Continuous Fiber Textile Yarn—150 series for many uses, such as electrical insulating tape, sleeving, cloth, roving, and paper reinforcement. Glass fibers have enormous tensile strength . . . 250 thousand pounds per square inch. High dielectric strength. Withstands temperatures up to 800°F.

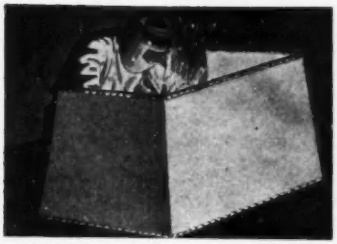


Super-Fine "B" Fiber—Splendid thermal- and sound-insulating qualities. Fiber diameter, .00012". Temperature range -0°F. to plus 450°F. Standard roll widths, 18", 24", 36", 72", in 100' and 200' lengths. Other widths and lengths also available in a range of thicknesses and densities.

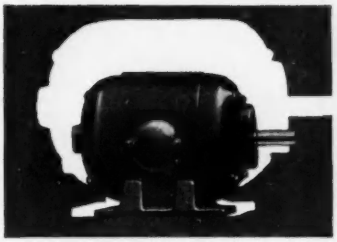


Super-Fine "AA" Fiber—primarily for aircraft insulation. Thickness, .5" with density of .6 lb. per cu. ft. Fibers of incredibly small diameter—.00004". With plastic binder to hold dimensional form. Roll widths, 36", 72", in 50' standard length.

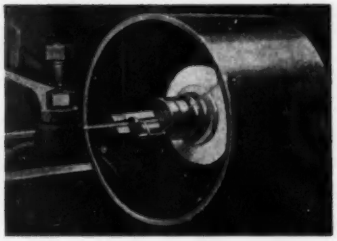
Roving, Chopped Strand and Textile Yarns—for reinforcing of plastics, paper, cloth and paper tape, etc. Enormous tensile strength. Won't shrink or stretch. Won't deteriorate under normal conditions. Versatile in application.



Industrial fabrics woven from Fiber·Glass are fine, safe, strong, rot- and mildew-proof. Ideal applications are tarpaulins, flame shields, airplane cloth, reinforcement for plastics.



Electric motors and generators insulated with L·O·F Fiber·Glass withstand heavy overloads. Appreciable space factor advantages! High dielectric strength.



Wire and cable can be served directly with L·O·F Fiber·Glass textile yarns using standard machines. Yarn also ideal for weaving tape, and braiding on wire and into sleeving.

fine, new facilities of L·O·F FIBER·GLASS!

Aviation, automotive, textile and electrical industries first to benefit from new, high-quality source of supply being readied by Libbey•Owens•Ford

HERE IS headline news of *immediate* interest to key men of business and industry.

The resources and advanced technical glass knowledge of Libbey·Owens·Ford are being focused on a new product—L·O·F Fiber·Glass!

With fine, new facilities at Parkersburg, W. Va., placed to serve you quickly, glass technicians of proven ability and experience are getting set to produce top-quality Fiber·Glass products in volume. (See facing page for basic items to be produced. Note above and right for typical applications.)

Across the country, in 24 major cities, L·O·F offices are busy with preparations to give you help on specific uses.

If your company has already discovered the superior qualities of fibrous glass, investigate L·O·F now as a new volume source, worthy of your complete confidence.

If your company now buys other material for electrical insulation, thermal or acoustical insulation, or reinforcing for plastics or paper, L·O·F Fiber·Glass can offer a combination of advantages unmatched by such other materials. This is a chance to benefit from the glass technology and the high standard of quality which you have come to expect from L·O·F!

For technical data, or engineering consultation on Fiber·Glass uses in your business, call your local L·O·F office—or write, wire or phone Libbey·Owens·Ford, Dept. F·G 112, Nicholas Bldg., Toledo 3, Ohio.

Plastic reinforcing, as in this bread tote tray, presents many possibilities with L·O·F Fiber·Glass. Remarkable strength. Won't dent or lose shape. No discoloration of plastic material. Exceptionally long life.

Paper and paper tape reinforced with L·O·F Fiber·Glass can be raised in tensile strength to equal aluminum or even steel! Either Fiber·Glass textile yarns or scrim mesh are suitable. Investigate!

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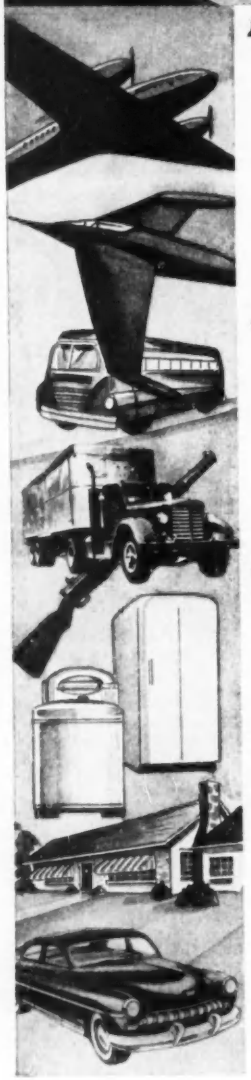

PAINT BONDING

"GRANODINE"® forms a zinc-iron phosphate-coating bond on sheet metal products—automobile bodies and fenders, refrigerator cabinets, etc.—for a durable, lustrous paint finish.

"LITHOFORM"® makes paint stick to galvanized iron and other zinc and cadmium surfaces.

"ALODINE",® the new ACP protective coating chemical for aluminum, anchors the paint finish and protects the metal.

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"PERMADINE",® a zinc phosphate coating chemical, forms on steel an oil-adsorptive coating which bonds rust-inhibiting oils such as "Granoleum."

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PROTECTION FOR FRICTION SURFACES

The oiled "THERMOIL-GRANODINE" coating on pistons, piston rings, cranks, camshafts and other rubbing parts, allows safe break-in operation, eliminates metal-to-metal contact, maintains lubrication and reduces the danger of scuffing, scoring, galling, welding and tearing.

IMPROVED DRAWING AND COLD FORMING

"GRANODRAW"® forms on pickled surfaces a tightly-bound adherent, zinc-iron phosphate coating which facilitates the cold mechanical deformation of steel, improves drawing, and lengthens die life.

Send for descriptive folders and Government specifications chart on the above chemicals. Write or call for more information on these products, and advice on your own metal-working problem.

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SAE Meetings

(Continued from page 72)

be the ultimate for anti-knock qualities but does maintain previously used valve and spark plug locations while considerably reducing combustion chamber volume in the cylinder head itself. The retention of valve positions allows maintaining the usual Hall-Scott construction using centrally located overhead camshaft and rocker-arm arrangement. It is felt that in general this combustion chamber gives very good results while at the same time retaining good water jackets and easily cooled ports and guide bosses.

The change in intake manifolding is shown diagrammatically in Fig 3. In effect this change is from dual three port manifolds to a long branch type with distributing chamber as near the carburetor as possible. The latter type manifold requires less heat to distributing zone for good distribution and acceleration and therefore gives better volumetric efficiency.

A tank truck and trailer combination built by Kenworth Truck Co. of Seattle and owned by Mr. Ray Ogg of Portland, Oregon, was powered with an

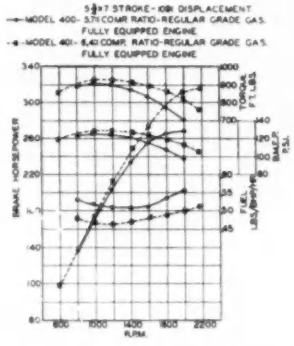
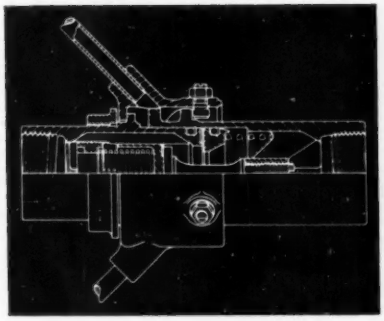

5¾ x 7 STROKE - 400 DISPLACEMENT
MODEL 400 - 5.75 COMP. RATIO - REGULAR GRADE GAS. FULLY EQUIPPED ENGINE
MODEL 401 - 6.40 COMP. RATIO - REGULAR GRADE GAS. FULLY EQUIPPED ENGINE
BRAKE HORSEPOWER
TORQUE FT. LBS.
B.M.E.P. PSI
FUEL LBS./BHP/HR.
R.P.M.

Fig. 1—Power torque, bmep, and specific fuel consumption of the model 400 engine compared with the revised version — model 401.

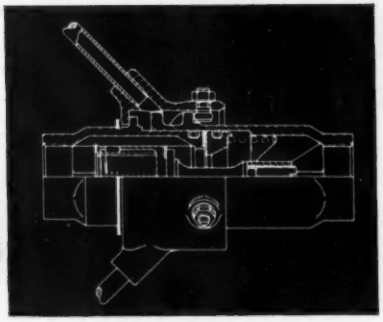
adaptation of a Hall-Scott 12 cyl marine engine. This is the only such installation and is rather an experimental unit. The marine engine is normally built with 5¾ by seven cylinder size with 6½ or seven compression ratio and develops better than 700 hp at 2100 rpm However, for the truck installation it was realized, of course, that the torque would have to be cut down as no transmissions or drive lines were available to hold the marine engine torque or power. Therefore, a six in stroke crankshaft was adapted from one of the 400 series engines and the compression ratio was reduced to 5½. Two nominal 1¾ in. duplex down-draft carburetors were installed in place of the three 2½ in. updraft units used on the Marine

2 TRUARC RINGS
ELIMINATE BULKY THREADED RETAINERS
...SAVE 41 MINUTES...$4.02 PER UNIT

OLD WAY Oversize internal and external retainers required costly milling, turning and threading operations. Assembly and disassembly (for inspection and seal replacement) was slow, difficult and expensive. Wall thickness and weight were excessive.



NEW WAY An internal (series 5000) and an external (series 5108) Truarc Ring are set into 2 grooves. Light, strong, economical Truarc Rings simplify assembly, disassembly, maintenance. Unit is smaller, more efficient. Greater accuracy because of positive stop positions!



Sperry Products, Inc., Danbury, Conn., saved 41 minutes in manufacturing and assembly time by using 2 Waldes Truarc Retaining Rings in place of old-fashioned threaded retainers in their self-sealing couplings! With Truarc Rings many tooling operations were eliminated... important savings per unit were made in raw material (1½ lbs. metal), overall size (3/16" diam.), and weight (1 lb.). Unit efficiency was greatly increased!

Redesign with Truarc Rings and you, too, will cut costs. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better job of holding parts together.

Truarc Rings are precision-engineered... quick and easy to assemble and disassemble. Always circular to give a never-failing grip. They can be used over and over again.

Find out what Truarc Rings can do for you. Send your blueprints to Waldes Truarc engineers for individual attention, without obligation.

USE OF 2 TRUARC RINGS ELIMINATED THESE COSTS

MACHINING:

outer shoulder ring: 15 minutes	$1.12
inner retainer: 20 minutes	1.50
threading: 4 minutes	.30
ASSEMBLY	.13
Total labor savings	$3.05
MATERIAL:	
brass threaded retainers	.97
TOTAL SAVINGS WITH TRUARC RINGS	**$4.02**

For precision internal grooving and undercutting... Waldes Grooving Tool.

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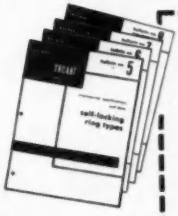

WALDES

TRUARC

REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,302,947; 2,302,948; 2,416,052; 2,420,021; 2,420,341; 2,439,785; 2,441,849; 2,459,165; 2,483,380; 2,483,393; 2,487,003; 2,487,803; 2,491,309; 2,500,081 AND OTHER PATENTS PENDING.

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.
Please send engineering specifications and data on Waldes Truarc Retaining Ring types checked below. AY-123

- ☐ Bulletin #5 Self-locking ring types
- ☐ Bulletin #6 Ring types for taking up end-play
- ☐ Bulletin #7 Ring types for radial assembly
- ☐ Bulletin #8 Basic type rings
- ☐ Send me information about the Waldes Grooving Tool.

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(*Continued from page 76*)
engine. In this manner the torque was reduced to a maximum net value of 1300 lb ft and the horsepower to a net value of 450 bhp. Even with this derating the rig must still be handled with some discretion to prevent overloading the drive components. Gross vehicle weight cannot be increased, of course, due to legal limits so that no greater loads can be carried on this rig than on the others in the fleet. It is reported, however, that running time can be reduced some 2½ hr over that required by other trucks in the same fleet with same loads. This on a route containing many steep grades over a distance of some 320 miles. Cruising is done at around 1500 to 1650 rpm. The engine has to date operated over 200,000 miles with one replacement of spark plugs. It is interesting to note that the gasoline mileage averages somewhat over four miles per gal, as good as, if not slightly better than the six cyl engines on the same route. This result seems to check with other findings indicating that gasoline consumption, other things being equal, is proportional to loads carried. This particular truck can seldom be accused of slowing traffic behind it.

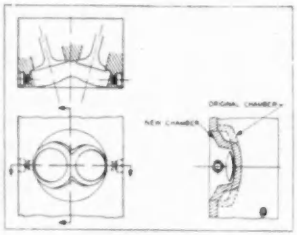


Fig. 2—Combustion chamber alterations in the model 401.

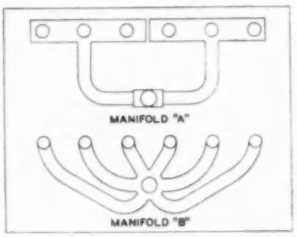
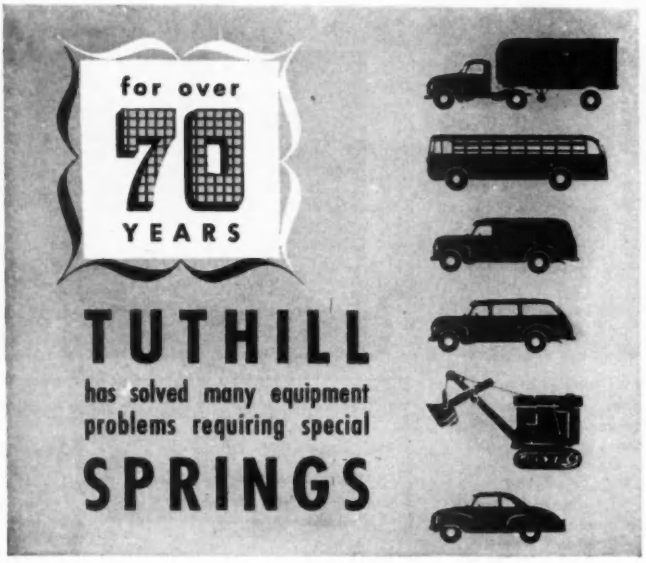


Fig. 3—Change in intake manifolding — manifold "A" is used for the model 400 engine while "B" is used for the 401 engine.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Design Factors Concerning Diesel Fuel Injection Equipment

By Sidney E. Miller
American Bosch Corp.

THE type of injection equipment most suitable for a given Diesel engine is of course determined by a large number of considerations, foremost among which are the engine size and output and speed, the type of combustion chamber, and the type of service. It is not proposed to discuss in detail the many well-understood factors that enter into selection of the general form of equipment, but the following observations will indicate their scope:

(a) Type of combustion chamber has an important bearing on the desirable type of nozzle, the desirable rate and duration of injection, and the desirable peak injection pressure.

(b) Size of the engine largely determines whether it is feasible to combine into one assembly with single drive the pumping elements for the individual cylinders.

(c) Power and speed of the engine, both as presently intended and as projected for the future, dictate the injection equipment's maximum capacity.

(d) Type of engine service has some influence on the choice of equipment and on the features to be provided in

(*Turn to page 80, please*)

XLO
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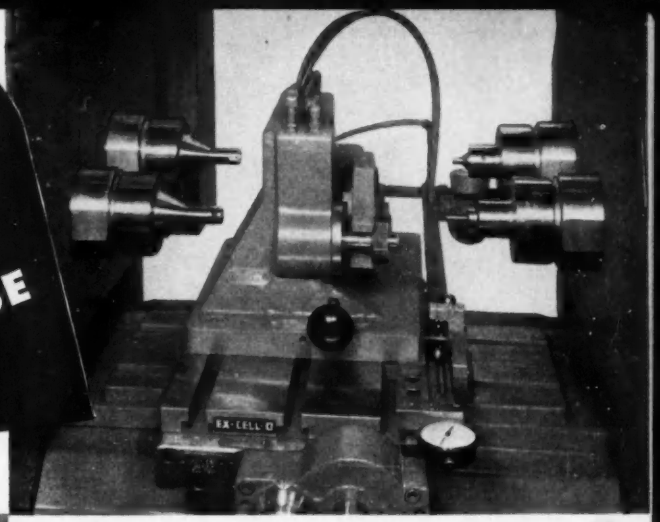
EX-CELL-O MACHINES SPEED DEFENSE



STYLE 1212-A PRECISION BORING MACHINE

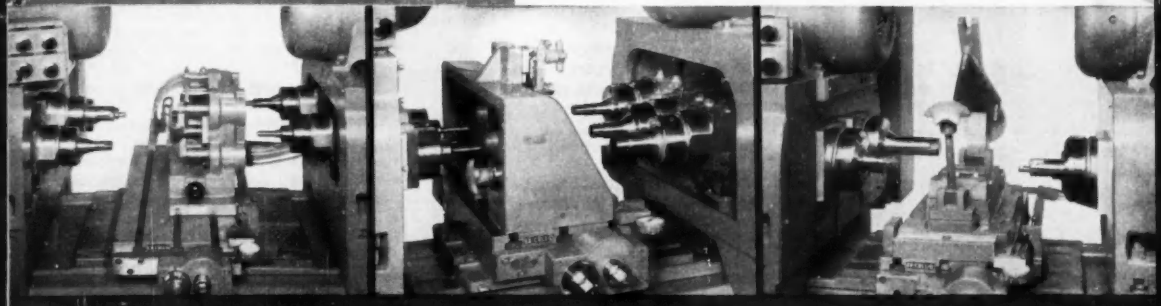
UPPER RIGHT: Style 1212-A Precision Boring Machine equipped with hydraulically clamping fixture supported by a manually operated cross slide for indexing. Operations are precision boring and line-boring.

BELOW: All eight Ex-Cell-O Precision Boring Machines on this job (like the three shown here) have push button controls conveniently located on the left bridges. The simple fixtures are mounted on cross slides to provide indexing between various boring positions.

Typical Installation Involves Eight Ex-Cell-O Precision Boring Machines

Typical of Ex-Cell-O's contribution to the defense program is the recent installation of eight double-end Ex-Cell-O Precision Boring Machines in one plant. Used to finish magnesium and steel parts for aircraft electronic devices, they hold bore diameters to within .0005", some hole locations to within .0005", others plus or minus .0002".

While this is not a large program by Ex-Cell-O standards, it is interesting as an example of the help Ex-Cell-O machine tools and engineering are giving our patriotic defense equipment manufacturers. If you can use help of this nature contact your local Ex-Cell-O representative or write, wire or phone Ex-Cell-O in Detroit today.



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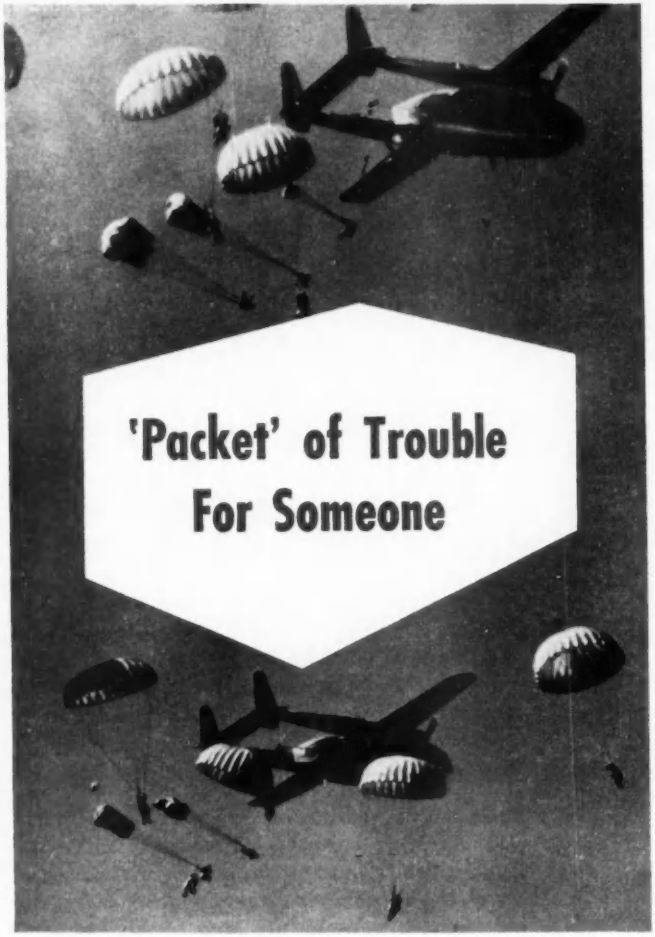

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(Continued from page 78)

the system. For example, if the engine is of the automotive type destined for truck or bus service, a suitable governor is often provided as an integral part of the pump, and this governor may be of the variable speed or the minimum-maximum speed type depending on the exact service requirements. If the engine is for tractor or shovel application, considerable torque back-up is required for lugging power as the speed decreases under load. The smaller the engine the more important is likely to be the cost factor, hence the demand for single-plunger distributor-type pumps on small multicylinder engines. Should the engine be large and destined for stationary use, and in a power plant or a pipe-line station, there may be a requirement for dual-fuel operation.

The problems of selecting proper materials and of specifying proper process control of them are not greatly different from those encountered in engine design. Dimensional stability of the parts is, however, a most important consideration in hydraulic devices and must be given a great deal of attention if proper function is to be maintained in the face of the many service variables of operation. Further-more, many of the injection equipment parts require high precision manufacturing to obtain the close fits and superfinishes, and materials and processes must be carefully chosen in some cases not only for maximum stability but for resistance to abrasion, resistance to erosion, resistance to static corrosion, reisstance to stress corrosion, resistance to heat, resistance to fatigue, resistance to impact, and resistance to stress deformation.

Since it is virtually impossible to find a single material which would possess the ultimate in all these properties, it is necessary to have full knowledge of operating conditions in order to select a material possessing for each class of application a suitable combination of properties. Composition is an important contributor in obtaining these properties, but in most instances microstructure plays a role of equal or greater importance.

The nozzle body may be cited as an example. First, it must resist sliding or abrasive wear—the sliding action of the valve stem and solid particles in the fuel. For such resistance its surface must be hard. The degree of hardness necessary may be controversial within a limited range, but it has been thoroughly proven that minimum values of Vickers No. 550 (Rockwell C-55) are essential. Along with a relatively high hardness value it is important that the surface microstructure be one of a homogeneous type. Somewhat similar surface characteristics

(Turn to page 83, please)

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Three Major Features

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SAE Meetings

(*Continued from page* 80)

are required to resist erosive action from the passage of high velocity fuel inside and high velocity gases outside.

Many fuels tend to corrode alloy steel parts even under static conditions, and nearly all of them are at least mildly corrosive under the conditions of temperature and pressure which exist in nozzles. Thus it is necessary to select a steel which is at least mildly resistant to corrosion, and in many instance it is essential to employ higher alloys of the stainless variety or nitrided cases, even at some sacrifice of physical properties.

In the selection of nozzle body materials it is important that the maximum operating temperature be known. If the operating temperature of the nozzle exceeds that at which the part was tempered during processing, there will be less of physical properties as well as dimensional changes, and functional misbehavior will result.

Alloy carburizing steels as used in nozzle bodies have fulfilled a wider range of requirements than other materials. Nozzle bodies are constantly subjected to high impact and fatigue stresses that render the through-hardening steels less suitable due to their tendency toward brittleness and cracking. The through-hardening steels are also more susceptible to seat-brinelling from the valve impact, apparently due to lack of resilience, a property which is present to a greater degree in a duplex alloy (case-hardened steels).

Heat-treating becomes an all-important phase in making a satisfactory nozzle body. The carburizing and the subsequent heat-treating operations should be carried on under carefully controlled conditions. Case depth and carbon concentration are the most important factors. A case too shallow will be short in life; an excessively deep case will cause embrittlement in thin sections. A carbon concentration of about the eutectoid content is most desirable (0.85 percent carbon). An abnormal carbon concentration will result in either excessive retained austenite, which is soft and unstable dimensionally, or carbide network at the grain boundaries with subsequent susceptibility to chipping and spalling of the surface layers.

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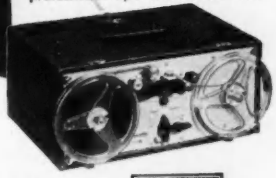

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MOTORS and CONTROLS

Machine Balances Engine and Torque Converter

(*Continued from page* 33)

fit the converter housing snugly for welding. Then a knife edge comes into play to cut the correction strip to the exact length required to produce balance. At the same time, a set of fingers comes into action to hold the strip as it is being cut. The fingers and strip then are transferred on a small conveyor to the welding fingers. On the way, the fingers are raised to clear the welding fingers and at the end of the conveyor stroke, the fingers drop down to load the correction strip into the welding fingers. If the strip required to balance the engine is over 2½ inches long, the welding unit will weld the strip in three places automatically.

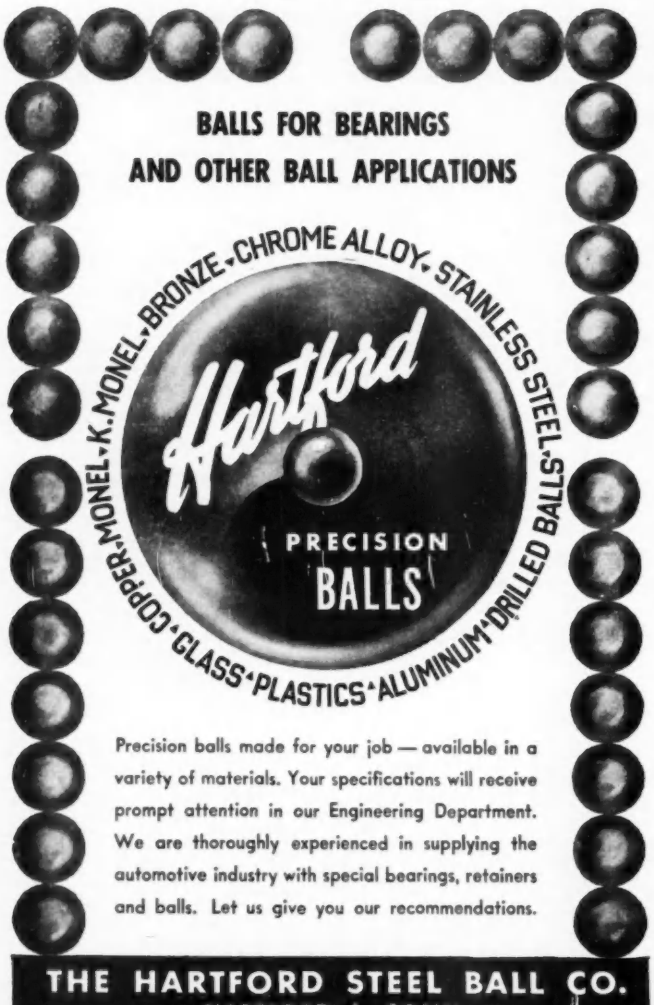
At the completion of this cycle, a green light goes on to indicate to the operator that the welding head is ready to operate. The operator now takes the "angle" reading recorded on the "dummy" wheel and again turns the rotating assembly by means of the large handwheel at the left to this angle. This maneuver lines up the torque converter housing in proper relation with the welding fingers for application of the balance weight. The operator then presses the "weld" buttons and the welding head comes into play to weld the strip to the housing. One, two, or three spot welds are made, the number depending upon the length of strip required for balancing.

It may be noted that the machine is provided with a number of safety devices and interlocks to control its operation under a variety of conditions. For example, if no correction is required in the left hand plane, the drill head will remain inoperative even if the operator presses the start buttons. Similarly, if no correction is required in the right hand plane, the feed mechanism will remain inoperative; and the welding head will not come into play even when the "weld" buttons are pressed.

Upon completion of the entire balancing operation—which, incidentally, takes less time than does this description—the operator restarts the machine and takes a check balance to make sure that balance is now within standard limits.

The advantages of this specialized technique are obvious. Chrysler exercises close quality control and balance of all rotating and reciprocating parts. Thus the pistons and rods are balanced, the crankshaft is balanced dynamically to a tolerance of ¼-oz in., and the crankshaft and torque converter assembly is held to a tolerance of one-oz in. Despite this, there remains the possibility of stacking up balance tolerances within a given engine that might result in rough operation despite the care taken in the production of individual parts and sub-assemblies. Balancing of the entire assembly in the manner described above removes all element of chance, produces engines with outstanding running balance, free from annoying vibration.

Still another advantage is the ability to detect a rare case of a tight piston or a tight bearing. The mechanism for rotating the crankshaft is provided with torque limit control which will prevent rotation if the engine requires excessive torque to turn over.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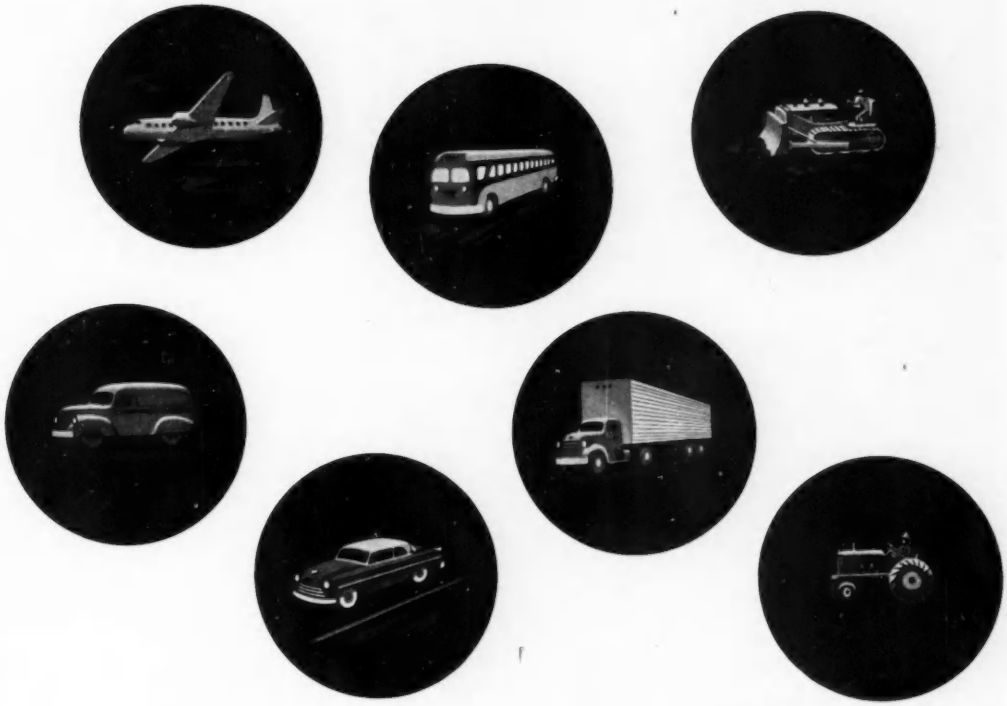

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Spinning Equipment

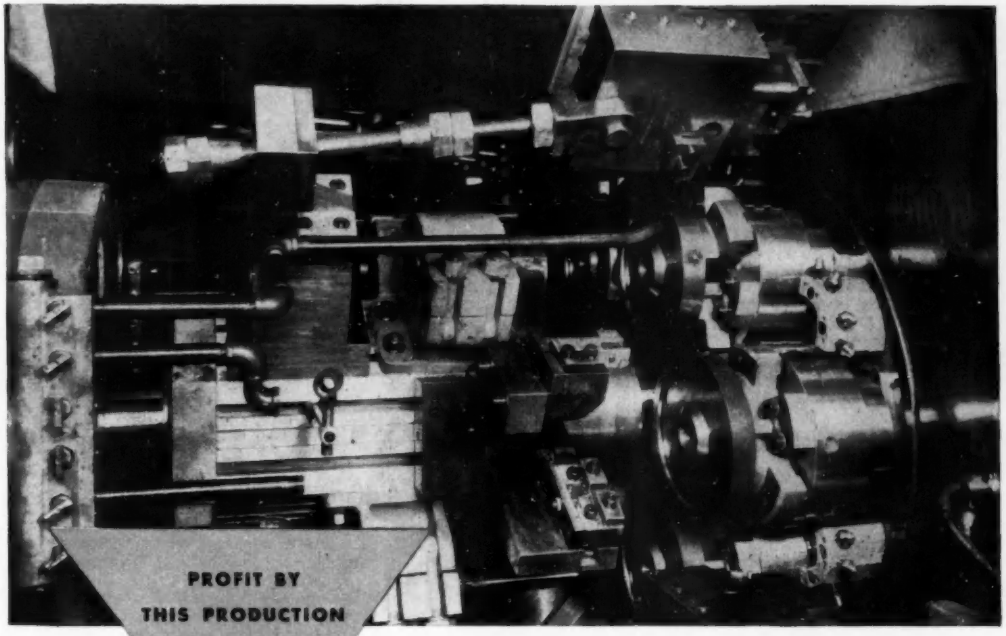
(*Continued from page* 44)

The big hydraulic spinning machine illustrated here was designed and built by United Specialties. Machines of this type are adaptable for a variety of spinning operations. Spinning technique is particularly effective in the production of conical-shaped work of any size and should be valuable in the making of cone-shaped parts for ordnance materiel. Apart from high productivity, a major advantage of the process lies in the ability to produce selective changes in wall thickness automatically. Thus, it is possible to produce work with reduced section along the elements of the cone and yet have the nose and flange come out with the original blank thickness.

The design of the United Specialties' spinning machine makes possible the development of any kind of configuration of the work simply by providing suitable dies and movement of the work ram. Although the process was initiated to meet the needs of the television industry, it is anticipated that it can be adapted just as readily for automotive applications as well as the requirements of the gathering military program.

The television industry is largely responsible for reviving metal spinning and the development of combined spinning and drawing methods to obtain maximum strength from a minimum of material. A stainless steel for the cathode ray tube was developed which had the same rate of thermo-expansion as glass. It was found that although it was almost impossible to draw this material which contained 28 per cent chromium, it was possible to spin it into a conical shape. In order to spin the material without work-hardening to the point where annealing was necessary, machines were developed which would deliver enough pressure to spin the material tightly against the form block with one pass of the spinning tool.

By spinning the metal back into a conical shape in one pass, the metal thins down and spreads out over the larger area of the spinning block or mandrel. The metal at both ends, however, is spun in such a way as to form a flange of original metal thickness, thereby giving added strength to the areas to which the glass face plate and neck sections are fused. The shell is made complete in one entirely automatic spinning operation without depending on the skill of the operator. Each unit is an exact duplicate of the others and very close tolerances are maintained. Due to the thinning action, which takes place in spinning, the material savings in a 16 in. round shell amounts to approximately $2.00 per unit.) In larger sizes, the saving is correspondingly greater.



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The advantages of automatic production are here extended to cover a broader range of jobs because Acme-Gridley machines are inherently versatile—can be changed over with a minimum of time and money invested in tooling, and yet offer maximum high speed production.

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JOB FACTS

PARTS —5 Sizes of Cam Shaft Gears (9" x 1⅝" size illustrated)

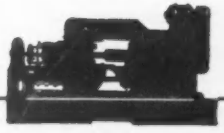
MATERIAL —Heat Treated Cast Iron

OPERATIONS—13

MACHINE —Acme-Gridley 10"—6-spindle RPA Chucker

TOOLING —Solid Carbide Inserts

MACHINING TIME—1 Minute-30 Seconds (for size illustrated)



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Power Steering for Modern Vehicles

(*Continued from page* 48)

desired bounds according to modern standards of driver comfort and safety. Hence, the virtual necessity for power steering on large motor trucks and buses, resulted first in its adoption for them. While not a "virtual necessity" on passenger cars today, the same reasons for its adoption on trucks and buses have a direct bearing upon its use on the larger models of cars, with certain advantages also offerable for practically all cars.

Power steering offers three very definite advantages, regardless of the type or size of the vehicles: (1) The amount of force required to turn the steering wheel may be made any amount desired by the manufacturer. (2) Any desired steering ratio may be used. The response or rapidity of change in the cramp angle of the front wheels may be established at any value desired regardless of the weight of the vehicle or turning forces required. (3) No force can be produced at the front wheels sufficient to overcome the driver's hold on the steering wheel. Steering control is afforded in case of tire blow-outs, running one front wheel off the road surface, or the introduction of any force producing a strong unbalance between the two front wheels. Each of these three basic advantages will be examined briefly:

(1) Tests over many years with which the writer is familiar, indicate that with manual steering the steering wheel rim pull must not exceed a maximum of 30 lb. When it exceeds this amount, control may be lost unless the driver is alert and physically able to exert a greater force in an emergency. For a woman driver the force must not be above the 15 to 20 lb range, preferably on the low side thereof. However, either of these forces causes fatigue if the vehicle is driven over winding roads, or where traffic and parking require frequent use of the steering wheel.

Although with power steering the minimum force can be made practically zero, and car and truck test installations with this characteristic have been made, it is recognized that the driver prefers a sufficient "feel" of the turning force to be assured that the front wheels of the vehicle are being turned. Also, in no case should the self-return or self-righting action of the steering assembly and tires be lost, or so greatly reduced that the driver must use force to return the wheel to the center position. To overcome gear friction and at the same time provide the desired feel of the steering wheel, a force of from two to three lb may be considered the minimum to give proper self-righting of the wheels. Some engineers engaged in power steering developments have preferred forces in the seven to eight lb range, which suggests that four or five lb is a good average value. Depending upon the type of mechanism used to obtain the power-steering action, the force can be made to increase to any desired maximum value with increased resistance to turning of the front wheels. However, the force required to turn the steering wheel when "dry" parking, should remain within the easy or comfortable range, else one of the important advantages of power steering will not be fully attained.

(2) While no final conclusions have been reached on just what steering ratio is most desirable, tests to date have shown that for best steering control involving rapidity of response in emergencies, easiest correction for side-wind effects, etc., an overall steering

(*Turn to page* 94, *please*)

This year again, Studebaker is using United Oil Bath Air Cleaners—this time for the new V-8 engine powering the 1951 Studebaker Commander.

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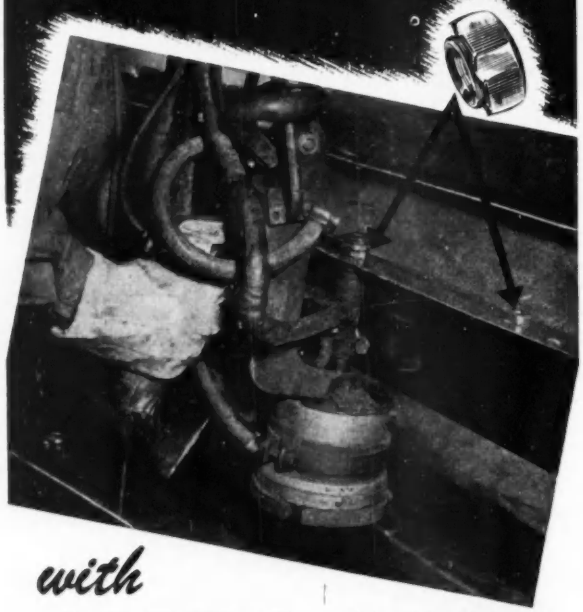

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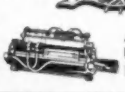

Air and Electro-Pneumatic DOOR CONTROLS

Power Steering

(*Continued from page* 90)

ratio of from 16 to 1 up to 18 to 1, corresponding roughly to three turns of the steering wheel, or slightly more for full cramp of the front wheels may eventually prove most desirable for both passenger and heavier vehicles. However, the fact that ratios in excess of 26 to 1 on cars, and well above 30 to 1 (nearly 40 to 1 in a few instances) on motor trucks are currently used, introduces the possibility of oversteering until the driver revises his steering technique. It is therefore noteworthy that Chrysler has adopted a turn ratio of approximately 16.5 to 1, thus closely approaching the ratio previously noted as very desirable. But, it is understood that dealers have recently been instructed to make certain that the purchaser of a car equipped with power steering be familiarized with its action before delivering the car. Some steering gear and car manufacturers apparently believe that the change downward in ratios should be made in successive steps, rather than all at once, especially if power steering becomes more generally adopted, as now seems possible.

(3) A very significant advantage of power steering results from the degree of irreversibility afforded when an external turning force is applied to the front wheels. This force must be resisted by the driver's force on the steering wheel, aided by that applied by the power-assisting system. The combined force is readily such that the steering wheel cannot be jerked from the driver's hands when the vehicle leaves the road surface, strikes an obstacle on the roadway, or should a tire blow.

In addition to the three basic advantages offered by power steering on any vehicle, a fourth accrues especially to the heavy-duty truck manufacturer and user. As already indicated on certain military vehicles, power steering practically eliminates any limitation on the weight carried by the steered wheels of the vehicle. A redistribution of total vehicle weight, with a greater proportion carried on the front wheels is thus afforded. Current objections voiced by highway legislative authorities may often be overcome in this manner while still keeping within maximum axle load requirements.

The question may naturally be asked as to why power steering should be important on passenger cars today, whereas acceptable steering has been obtained heretofore. Generally the answer is that to cope with the recent adoption of lower tire inflation pressures and increased front end weights a few years ago, steering ratios had to be further increased to keep the steering wheel turning force approximately the same as before. Even so, inflation pressures above those recom-

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mended by some tire manufacturers are being used although changes in tread widths and contours have been adopted which tend to reduce the turning force. Proponents of power steering for cars, along with truck and bus operators whose vehicles have been so equipped for some time, make the point that passenger cars should be made easier and safer to handle, just as have some heavier types of vehicles.

Since the power steering systems under discussion herein are of the servo or assistance type, the same basic principles apply to them as to any other servo system. The system must receive some "signal" that its help is needed. Also, there must be some lag, however small, between the time the signal is received by the system and the servo acts. Many problems have had to be overcome in solving these factors, including associated oscillatory and vibrational effects. Today only the hydraulic type of servo system has survived the development period in so far as highway vehicles are concerned, so these systems only will be covered herein. Before discussing the various systems individually, a few general remarks will assist in distinguishing between the various types now in use or under current development.

The signal given the servo system must be a force and consequent movement however small applied to some part of the conventional steering mechnism. Either the steering wheel or the front wheels of the vehicle must be moved slightly to actuate the servo. If it is the steering wheel a definite requirement is that only a small movement is permissible and when the servo acts, the start of such assistance should not be objectionable to the driver else the feeling may be created that the steering wheel is momentarily being taken away from his control. Since the conventional steering gear usually affords adequate control near the center position of the front wheels, the exact amount of movement may be made as desired by the manufacturer. More important is the fact that the servo engagement be almost if not completely unnoticeable, and if the force or shock comes from the road wheels, the reactionary effect on the steering wheel should be well within the limits of quick and easy repositioning of the steering wheel by the driver. The minimum values for steering wheel movement have not been standardized as yet, but tests indicate that up to two in. either side of center may be considered the maximum for motor trucks and other large vehicles, down to a minimum of about $\frac{1}{2}$ in. for passenger cars.

A second important factor is that the servo be capable of supplying the necessary force as rapidly as desired by the driver. The size of the hydraulic-assisting cylinder, connecting tube and port areas, and the capacity of the hydraulic pump influence this follow-up control. Both pressure and available rate of oil flow must be sufficient, especially when the engine is idling if the pump is engine driven as is the case on systems preferred today. Two methods are currently under development, (a) the use of a pump driven at approximately engine speed (0.9 to 1.2 times), of a size providing adequate flow and pressure at an engine speed of around 400 rpm, in which case considerable overcapacity exists at maximum engine speeds, and (b) the use of a small pump driven at approximately twice engine speed. Since pump noise may be sufficient to be objectionable, means of insulating the pump mounting from the engine and chassis, including rubber lining of the oil supply tank, and rubber mounting of the steering column may be required. The excessive capacity of the pump at high engine speeds also may heat the oil supply and aggravate any impulse effects from air entrained in the oil, or from the pulsations in the flow of oil which characterizes pumps of some types. Pump noise is most noticeable at engine idling speeds, and operation at twice engine speed (up to 8000 rpm or higher) may cause cavitation of the oil entering the pump with a material increase in noise. To overcome this objection a so-called "fluid booster" was developed several years ago. The "booster" is a

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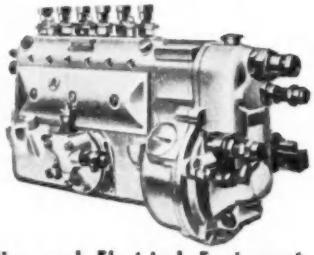

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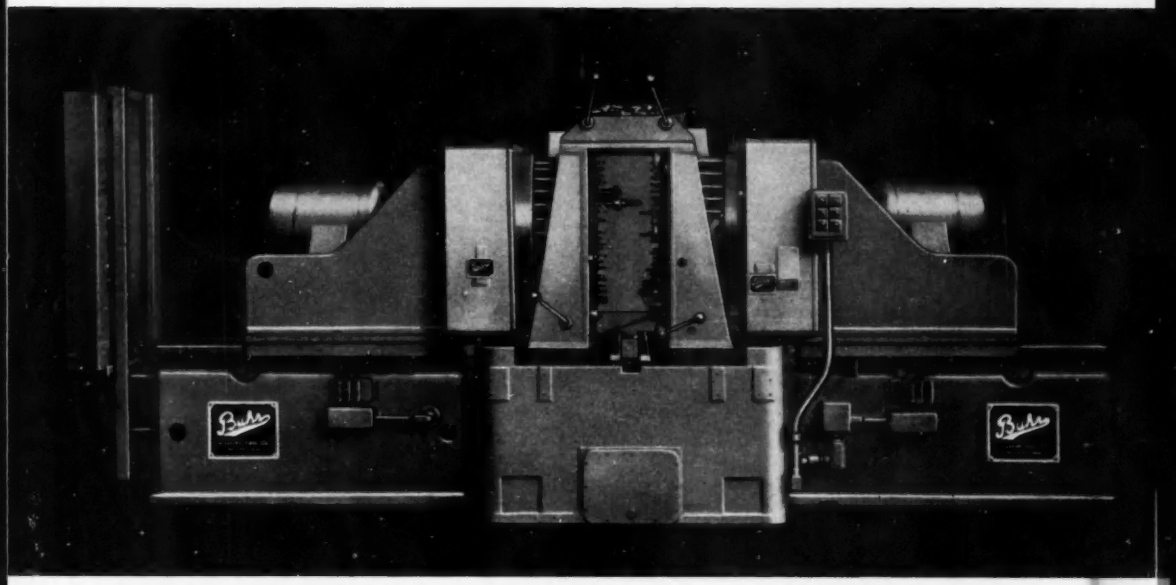

It's not tanks, planes, guns, ships, atomic bombs and armed forces that Joe Stalin hates . . . It's the productive power behind them—productive power that is symbolized by this Buhr Two-Way Hydraulic-Feed Drilling Machine which is now hard at work day-in and day-out . . . helping one of the world's largest manufacturers turn out automatic transmission cases for tanks . . . This kind of Machine —more than anything else—is what Stalin hates.

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Drills (1) 29/32" diameter hole through
Drills (1) 7/8" diameter hole 3/4" deep
Drills and countersinks (2) end cover dowels on vertical center.

From the right:

Drills and counterdrills (11) #1 holes
Drills and counterdrills (8) #2 holes
Drills (12) #3 holes through
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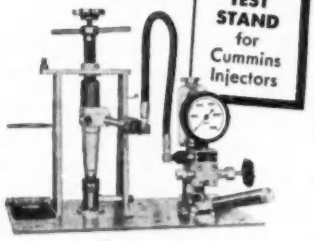

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venturi arrangement introduced at the pump intake which serves to fill any cavitational voids as well as to remove entrained air should it enter the hydraulic system due to power cylinder or pump gland leakage. Pumps of gear, rotary and piston types have been tested to date. The Eaton Rotor pump, the Vickers and others are now used or are under consideration. A small pump having specially designed gears and used with a booster has proved quite acceptable also.

The capacity of the pump at pressures in the now current range of 500 to 1000 psi varies with the type of application. For trucks and buses a capacity of 1.25 gpm, giving a servo-assistance rate of 10 sec or less for full cramp of the front wheels from right to left or vice versa is recommended by one steering gear producer. For passenger cars a much faster follow-up speed is considered desirable, approximately four to five seconds for full front wheel cramp, or from two to three seconds for right or left cramp from the center position, with the lower value preferred. While varying with front wheel loading, tire turning torque characteristics and steering gear efficiency, the maximum steering wheel rim force or pull on aheavy vehicle may run up to six times that considered desirable for cars, and for the turning rates indicated may require a pump capacity of approximately three times that for cars.

Since power steering should be available at or near engine idling speeds the pump may have considerable excess capacity at high engine speeds. The capacity in excess of that required for steering also may influence pump noise and cavitation. Pump pressures above those required may also be developed. The hydraulic system may therefore be equipped with a pressure control or relief valve, and more recently constant flow valves have been used, one bypassing oil within the pump body. Constant flow control valves, now sometimes termed "unloader valves," assure a substantially uniform follow-up rate for the servo regardles of pump speed.

Although most power steering systems in use today utilize the so-called "open valve" wherein oil flow is continuous through the control valve and pump until intercepted by the servo signal, closed circuit types with accumulators are now in use where the oil flow serves other control elements on the vehicle. (6) The open-valve system is simpler, but requires that the engine be running to supply pressurized oil for power steering, whereas some oil is available under pressure with the closed system for servo actuation when the engine is not running. Since manual steering is always available with the systems under discussion, steering control is likewise present in case of damage to the hydraulic system or loss of pressure due to engine stalling. However, if the steering ratio has

(*Turn to page* 102, *please*)

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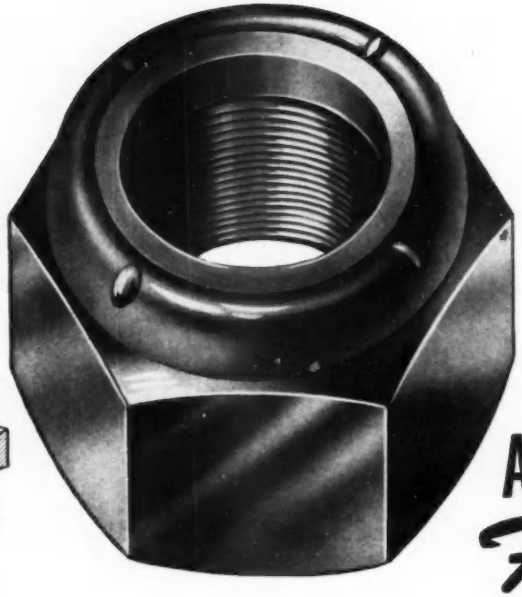

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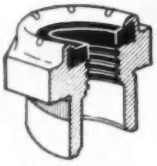

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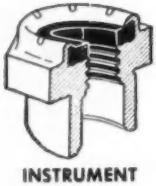

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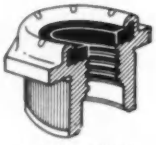

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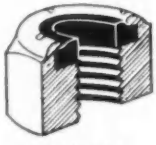

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Mexican Company Organized to Build Fiat Cars and Trucks

By Emil Zubryn

Mexico City, Mexico—

WITH a definite accord reached with Fiat of Italy for the construction of Fiat cars and trucks in Mexico, the new corporation has been formally created with the name of Dina-Fiat, S. A. de Mexico, and with offices established on the 10th floor of Dolores 17 in Mexico, City. Capitalization is, as planned, at $8,500,000 with 50 per cent of this sum advanced by Nacional Financeria, government bank agency and the rest subscribed by well known Mexican business men, including Luis Montes de Oca, Bruno Pagliai, Antonio Ruiz Galindo, Gaston Azcárraga and others.

Head of the Board of Directors is Ramón Beteta, Secretary of State and Public Credits. Managing director is Luis Chico Mena. Board members include such prominent names as Rafael Mancera, Under Secretary of State; Antonio J. Bermúdez, managing director of Petroleos Mexicanos; Carloas Novoa, managing director of the Bank of Mexico; Antonio Carrillo Flores, managing director of Nacional Financeria. These represent the "A" voting stock and for the series "B" board members include Bruno Pagliai, Hugo Salinas, Dr. Aurelio Peccei, Antonio Ruiz Galindo, Gaston Azcárraga, and others.

As reported before, Rodrigo Gomez, under-secretary of the Bank of Mexico, made a special trip to Italy to conclude the deal with Fiat officials. Fiat has only made a token cash payment into the new company with its direct participation being the supplying of technical aid until the new factory starts operations. They have also shipped dies, machine tools and within four months will send technical engineers to Mexico to advise on installation of equipment and see that construction and preliminaries to production are properly executed. The Fiat home office will also ship a number of cars and trucks which will be used for publicity purposes and as models for the fabrication of the Mexican made Fias.

A site has already been picked in the state of Hidalgo, although exact location has not been revealed because final arrangements and contracts have not yet been signed. It is stated that the site has direct railroad facilities and all the facilities necessary for a plant of this type. Officials of the new firm state that production of new cars and trucks will be under way in less than a year.

A group of 50 Mexican automobile workers are being picked, to be sent to the Fiat plant in Italy to receive thorough training in production techniques. They, in turn, will train other Mexican workers for tasks requiring specialized, technical knowledge.

Magnitude of the Mexican Fiat plant can be seen from fact that it will cover a minimum of 1848 acres. The plant's production will be 1000 trucks per year, sufficient to cover all operational costs. It will also produce a special Fiat model called the 1400, similar to the Opel car which is assembled in Mexico City by General Motors. Possibly, too, at first parts will be imported from Italy for trucks and cars when assembly work begins. Trucks constructed here will be Diesel powered.

Most of the essential materials for the new plant will be obtained within Mexico, and principally from the iron and steel plant of Altos Hornos de Mexico, S. A. The new plant is being organized to turn out products which can be sold at low prices in competition with the U. S. automobile industry.

Aurelio Peccei and Francisco Martina, of the Fiat home office, have been officially appointed Fiat representatives in Mexico.

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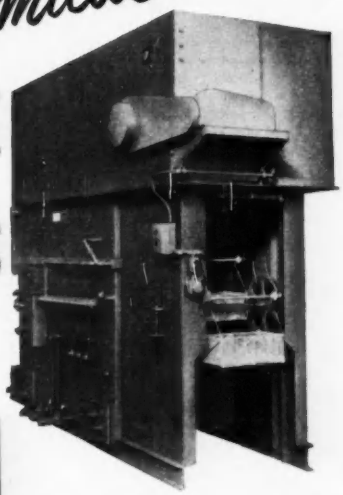

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Power Steering

(*Continued from page 98*)

been reduced with the installation of a power steering unit, the steering wheel turning force is much greater than when the normal manual steering ratio is used.

Electric motor-driven pumps have appeared sufficiently attractive for several installations of power steering units on trucks. However, in excess of one hp is required for large vehicles, which necessitates an increase in the generator charging rate, and a larger battery under winter driving conditions. Since the electric motor-driven pump ordinarily need supply oil under maximum pressure only during parking or slow vehicle operation, much of the power is wasted under normal driving conditions. The weight of the electric motor-driven pump is not a factor against its use in large vehicles since units of approximately 24 lb weight, using the postwar aircraft type motors, have been developed and tested.

In concluding this section, it should be noted that with thousands of power steering assemblies in use today, ample service experience has been accumulated to assure reliability as to both the functioning and to the life of the units. Manufacturing limits for the valve parts, methods of minimizing leakage under high actuation pressures, pump types, preferred types of oils, tubing sizes, connections, cylinder mountings, etc., have all been developed and evaluated.

Details relative to the various types and makes of power steering assemblies on the market or under development today will be presented in Part II of this article, which will appear in an early issue of AUTOMOTIVE INDUSTRIES.

BIBLIOGRAPHY

(1) Unpublished Report, Engineering Dept., Pierce-Arrow Motor Car Co., E. B. Neil, March 20, 1916.

(2) Bowen patent, 1,120,016; Mustin 956,718; Carr 1,297,095.

(3) AUTOMOTIVE INDUSTRIES, Dec. 10 and 17, 1932, P. M. Heldt; *Commercial Car Journal* and *Operation and Maintenance*, July 1929.

(4) *Automobile Topics*, July 7, 1928, Davis Hydraulic Power Steering.

(5) *SAE Journal* (Transactions), April 1945, Power Steering for Automotive Vehicles, Francis W. Davis.

(6) Pre-print, SAE Paper, "Hydraulic Devices for Commercial Vehicles," G. W. Pontius, Bendix Products Div., before Chicago Section, March 3, 1947.

*A rough approximation of the number of steering wheel turns for full front wheel cramp, may be obtained by dividing the steering ratio by 4.3. For instance a 25 to 1 ratio requires about 5½ steering wheel turns, a 15 to 1 ratio about 3 1/3 turns.

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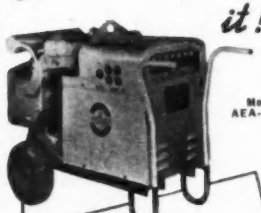

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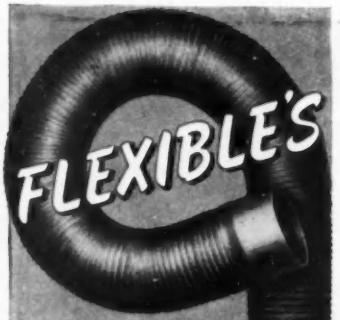

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(Continued from page 59)

side force on the aircraft, and, by means of an electrical servo system, deflects the rudder to neutralize the side force. Proper dynamic design assures coordinated sharp or slow turns without using rudder pedals. Unique mechanical connection of the sideslip stability augmenter actuator into the rudder control system eliminates rudder pedal motion during its operation. Full rudder is available to the pilot for such special maneuvers as deliverate sideslips.

An important characteristic of the device is that dynamic lateral stability many times greater than normal is available with no loss in controllability.

S-34—Filler Cap

Ross & Amann Inc., New York, N. Y., have announced the production of a filler cap for pressurized fuel and oil tanks. This cap, manufactured by Lightolier, Jersey City, N. J., is said to fulfill all the requirements of Air Force spec. No. 28654 Types I and II size three. It will hold pressure from zero to 250 psi. It incorporates a warning flag which is visible when the cap is not locked in place and which lies flush when the cap is locked. The mounting flange is interchangeable with flange AN4123. A flush type version is also available.

S-35—Fluid Line Identification

A method of identifying aircraft fluid lines by means of self-sticking tape markers has been announced by W. H. Brady Co., Chippewa Falls, Wis. These markers are made of a cotton cloth with a silicone plastic coating. They come mounted on dispenser cards.

These fluid line identification markers conform to Air Force-Navy aeronautical standard AND10375. Brady markers are stocked in two different ways: with system name printed on the approved background color and with the appropriate symbol, and with the color bands and symbols only.

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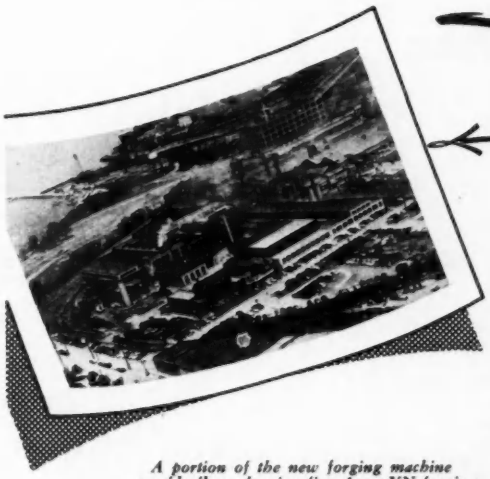
ELOX ELECTRON DRILLS* are now being used by the largest automotive firms, heavy and light manufacturing firms and divisions of the U. S. Army and Navy. *T.M. Reg.

WRITE FOR COMPLETE DETAILS AND LIST OF USERS

ELOX CORPORATION OF MICHIGAN

742 N. Rochester Rd., Clawson, Mich.

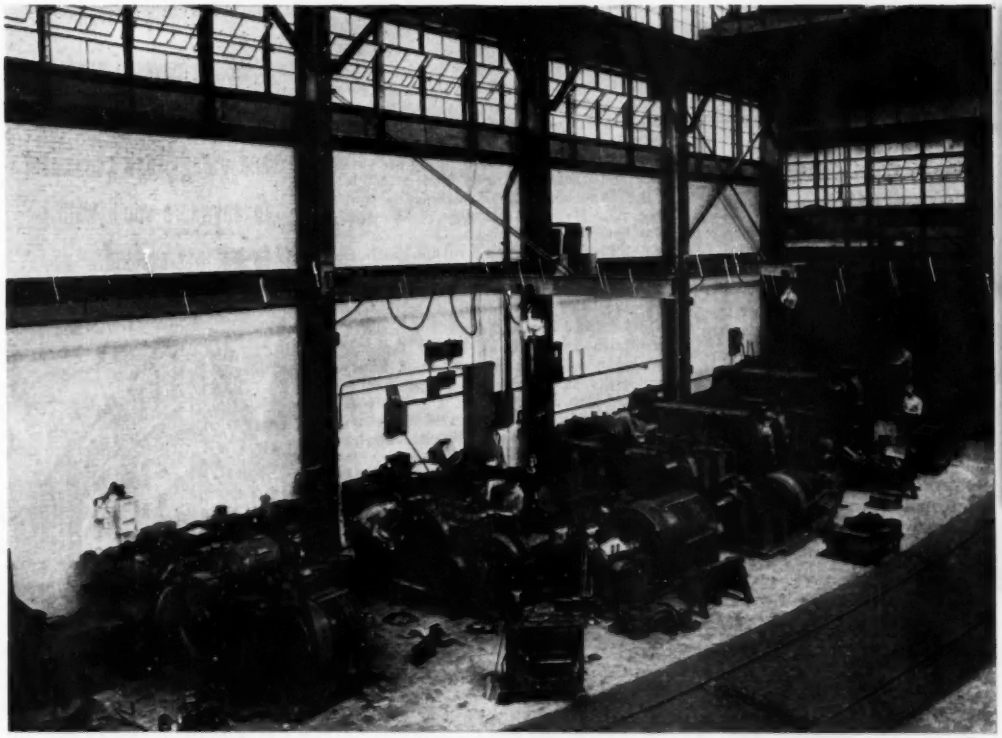
Western Division: P. O. Box 27, Inglewood, Calif.



A portion of the new forging machine assembly floor showing five Acme XN forging machines in various stages of completion.

Thanks to you...

● We are proud of our record of 68 years producing constantly improved forging machines. Owing to the increased demand for these forging machines, we have been obliged to expand our plant facilities. Adding new buildings (shown in the plant aerial view) and integrating the several divisions of the Hill Acme Co. have insured our efforts to increase production and step up the efficiency of all our divisions.

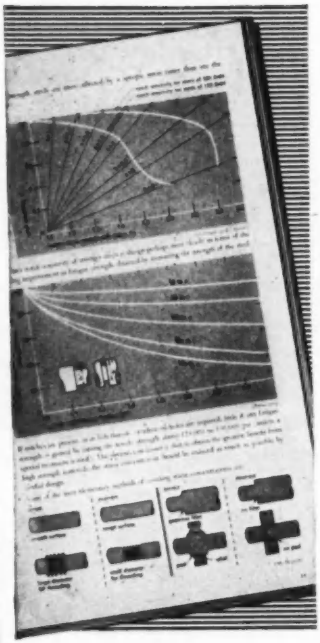


THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 1209 W. 65th St., Cleveland 2, Ohio

ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES



Every designer must be something of a metallurgist

Here are 72 pages packed with information of vital significance to engineers faced with the design, selection and treatment of steel components to give a specified service at minimum cost.

Besides dealing with scientific design, the book gives important metallurgical data, all compiled from the designer's viewpoint. Free on request.

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Pontiac

(*Continued from page* 49)

When the selector lever is moved into the right hand "DR" position, it brings into play only the first, second, and third speeds, through a suitable change in the control valving. This range is recommended for ordinary city driving in heavy traffic, for improved uphill climbing, better downhill braking, and in general where high acceleration is desired.

The familiar kick-down feature for passing and emergency acceleration operates in both "DR" ranges to provide an extra measure of safety on the road.

The "Lo" position, usually reserved for operation on icy roads, on snow or sand or mud, is arranged to use second gear rather than first gear. However, even with this new control, kick-down at speeds below 10 mph will cause a shift to first gear.

In addition to changes in valving and control to effect the operations described above, detail changes have been made to make the overall operation of Hydra-Matic smoother than before. One of the improvements designed to facilitate "rocking" is the introduction of a new exhaust valve in the rear servo mechanism, which promotes easier and faster changes from "Lo" to "R." Another item of interest is that the new Hydra-Matic now is identical for both sixes and eights.

Although unchanged in mechanical detail, both 8- and 6-cylinder engines are offered in a high compression ratio version and are installed with the Dual-Range Hydra-Matic drive. They are also available at option for use with manual shift transmissions. However, the standard engines can be installed with Hydra-Matic if so desired.

With compression ratio of 7.7 to 1, the 8-cylinder engine develops 122 hp (max.) while the 6-cylinder engine is upped to 102 hp (max.). On standard engines compression ratio has been increased to 6.8 to 1, boosting the eight to 118 hp, the six to 100 hp. Premium fuels are required with the new 7.7 to 1 compression ratio engines.

Several noteworthy improvements are found in accessory features. Generator output is increased to 45-amp; and a special generator of 50-amp capacity is made available for police and fleet operation, particularly where radio-telephone equipment is installed. Generators now have a simple lubrication arrangement and the service band around the housing has been removed. A new method of brush mounting is said to increase brush life.

E-Z Eye safety glass is offered as optional equipment. A new motor driven radio antenna is available. Another optional feature is a hand brake signal, flashing red as ignition is turned on to prevent driving with the hand brake set.

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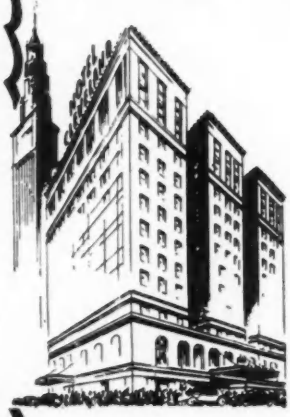
Hotel Cleveland
you'll enjoy
friendly, attentive service...
delicious food...
quiet, sleep-inviting rooms...
a sincere and hearty welcome.

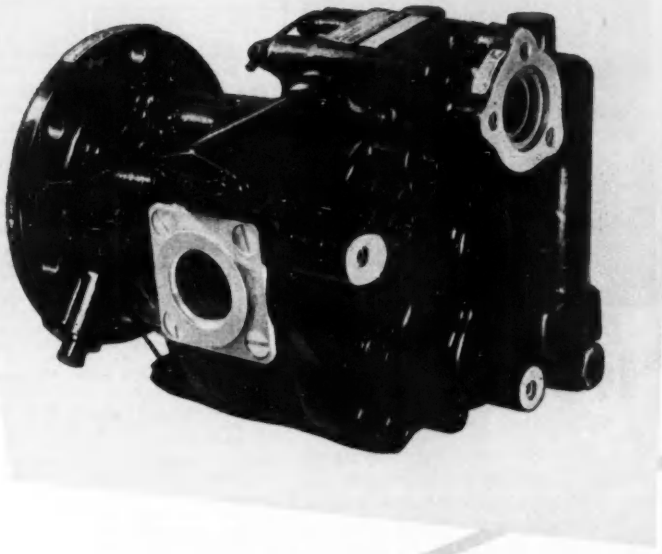
★

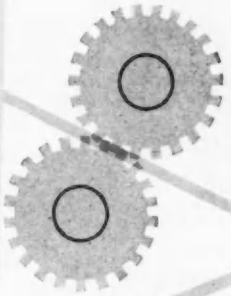
You'll be only a step
(through covered passage)
to Union Terminal trains
and garage, and convenient
to anywhere you'll want
to go in Cleveland.



All rooms with radio—many with television.

Hotel Cleveland
CLEVELAND, OHIO





Geared to pump longer at higher pressures . . .

THOMPSON GEAR PUMPS

New in the full line of Thompson service-proved pumps, the Thompson Gear Pump fully meets today's requirements for a dependable high-pressure fuel pump for jets.

Pressures up to 800 psi. are handled by the Thompson Gear Pump. Extra-close tolerance in the pumping chamber assures positive action and high efficiency, helps maintain required pressures.

In all Thompson Pumps, the combination of experience, engineering, and workmanship helps protect their world-wide reputation for dependability and low-cost maintenance.

May we tell you more about the Thompson Gear Pump . . . or any other pumps in the Thompson line?

Typical Thompson dual element Gear Pump Model rated at 38 GPM and 600 psi. at 3600 RPM.

Pump is designed for use with all military fuels over temperature range of −65° F. to +165° F.

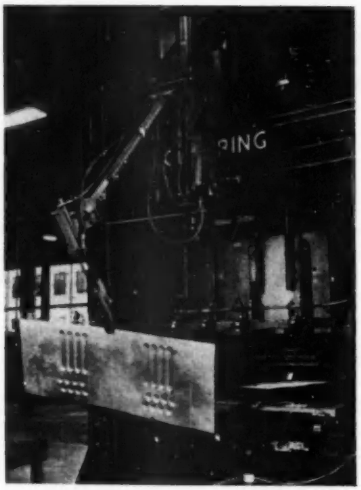
ACCESSORIES DIVISION

Thompson Products, Inc.

EUCLID, OHIO

YOU CAN COUNT ON THOMPSON FOR ENGINEERING LEADERSHIP

Hotpoint improves safety and production with sahlin "iron hand"

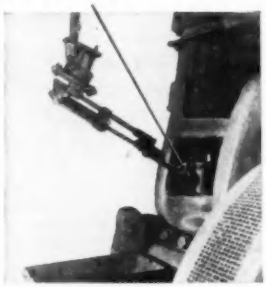


Automation—the new production technique which moves parts into and out of presses with minimum manual handling—can be applied efficiently to single units as well as complete production lines. At Hotpoint Inc., Chicago, three 250-ton presses are set up for manual feeding, but *automatic unloading*. Sahlin "Iron Hand" unloaders lift eight-lb. oven liners out of dies as rapidly as the presses can form them. Advantages: higher production ...lower cost...greater safety.

Dozens of manufacturers have found the "Iron Hand" simple to operate, dependable in action. It can be synchronized with the press cycle and can be set to remove the stamping at any moment during the upward stroke of the press ram. *Here's how it works:* steel jaws move into the die the moment the ram starts its upstroke, grip the stamping firmly, swing it out to a table or conveyor. The arm and jaws are easily adjustable for different width parts, loading heights and distance and angle of swing.

Four sizes of "Iron Hands" and six types of gripping jaws have been perfected by Sahlin engineers for the automatic unloading of stampings—large and small. Unloader speeds as high as 42 spm are practical for short stroke work. For more information, write for our new catalog.

Unloads stampings as large as auto roof...as small as this bracket.



Besides eliminating a hazardous unloading operation at DeLuxe Stamping Company, Hazel Park, Michigan, the "Iron Hand" increased production 25%—to 1000 stampings per hour.

Raise Press Room Standards with the Sahlin "Iron Hand"

sahlin
engineering company

267 Ferndale Street, Birmingham, Michigan

CALENDAR

OF COMING SHOWS AND MEETINGS

Motor and Equipment Wholesalers Ass'n (Annual Convention) Chicago, Ill. ..... Dec. 3, 4, 5

1952

Brussels Automobile & Truck Show, Brussels, Belgium ..... Jan. 19-30

42nd National Motor Boat Show, New York City ..... Jan. 11-19

Plant Maintenance Show, Phila., Pa. ..... Jan. 14-17

SAE Annual Meeting, Detroit, Mich. ..... Jan. 14-18

Society of Plastics Engineers, Inc. (eighth annual technical conference), Chicago, Ill. ..... Jan. 16-18

Truck-Trailer Manufacturers Association (11th annual meeting), Houston, Texas ..... Jan. 28-30

19th Chicago National Boat Show, Chicago, Ill ..... Feb. 1-10

Automotive Accessories Manufacturers of America Exposition, New York, N. Y. ..... Feb. 4-7

Chicago Automobile Show, Chicago, Ill. ..... Feb. 16-24

National Transport Vehicle Show & Fleet Maintenance Exposition, New York ..... Feb. 26-28

Pacific Automotive Show, Los Angeles, Calif. ..... Feb. 28-Mar. 2

Amsterdam Automobile Show, Amsterdam, Netherlands .. Feb. 29-Mar. 10

ASTM Spring Meeting, Cleveland, Ohio ..... Mar. 3-7

SAE Passenger Car, Body and Materials Meetings, Detroit, Mich... Mar. 4-6

Fifth National Plastics Exposition, Phila., Pa. ..... Mar. 11-14

ASTE Industrial Exposition, Chicago, Ill. ..... Mar. 17-21

Geneva Automobile & Truck Show, Geneva, Switzerland ..... Mar. 20-30

American Society of Lubrication Engineers, Seventh Annual Meeting and Lubrication Show, Cleveland, Ohio ..... Apr. 7, 8, 9

SAE Aeronautic Meeting, New York, N. Y. ..... Apr. 21-24

Turin Automobile Show, Turin, Italy ..... Apr. 23-May 4

International Foundry Congress and Show, Atlantic City, N. J..... May 1-7

API Div. of Refining, San Francisco, Calif. ..... May 12-15

American Society for Quality Control (sixth annual meeting), Syracuse, N. Y. ..... May 22-24

SAE Summer Meeting, Atlantic City, N. J. ..... June 1-6

American Society for Testing Materials (annual meeting), New York City ..... June 23-27

SAE West Coast Meeting, San Francisco, Calif. ..... Aug. 11-13

Instrument Society of America (sixth annual meeting), Cleveland, Ohio Sept. 8-12

SAE Tractor Meeting, Milwaukee, Wis. ..... Sept. 9-11

Paris Automobile Show, Paris, France Oct. 2-12

37th International Motor Exhibition, London, England ..... Oct. 15-22

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HANDMADE SAMPLES

SHORT RUN PRODUCTION

MAGNESIUM
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Skeleton wood form, 100" x 20", for handmade jettison tank.

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METAL FORMED FROM CEMENT DIES

No other company in the United States offers this diversified approach to your tooling problems, for we are restricted neither in the type of die materials to be used nor the type of presses upon which the part will be formed. The quantity always determines the expenditure.

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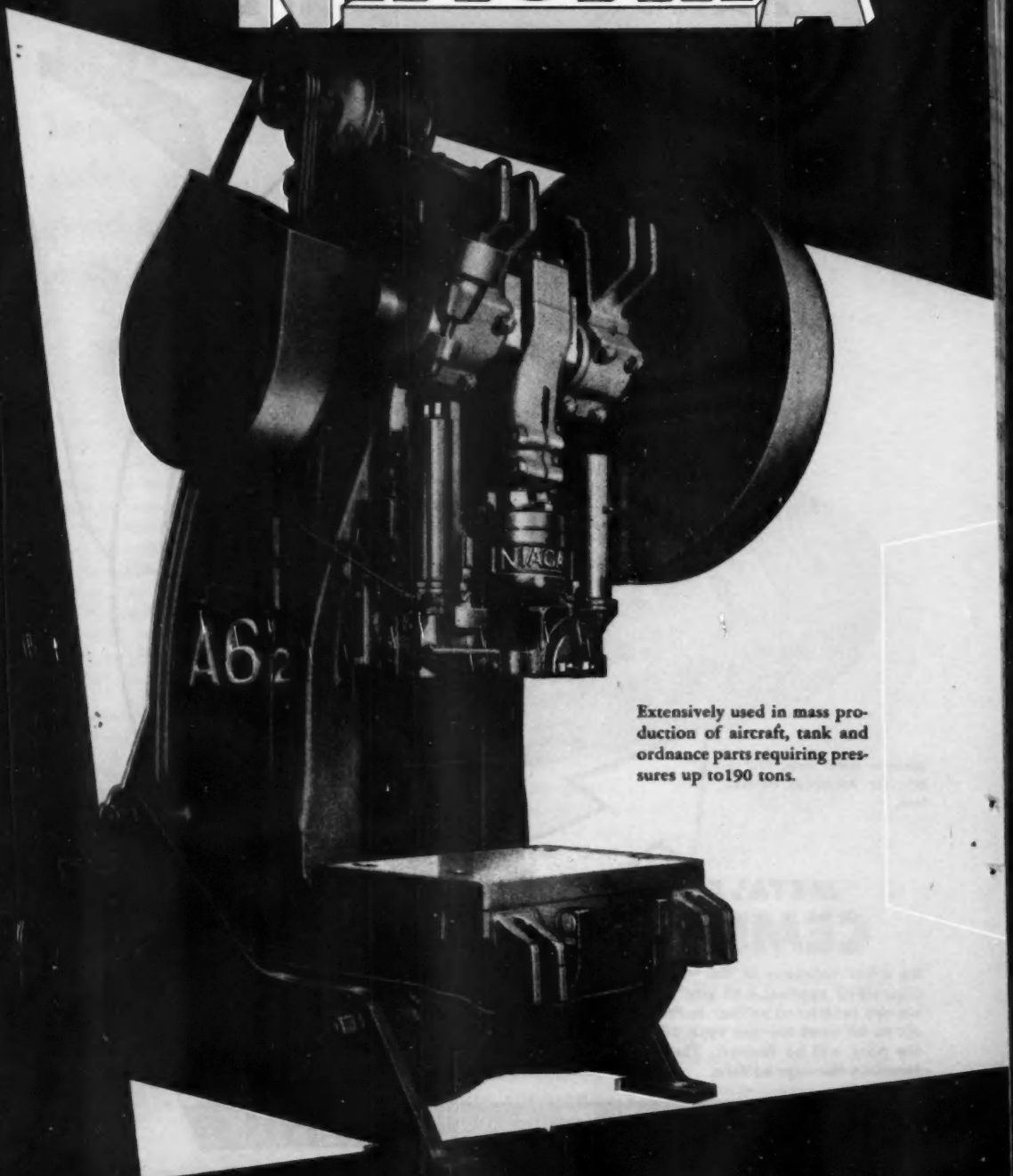
NIAGARA



Extensively used in mass production of aircraft, tank and ordnance parts requiring pressures up to 190 tons.

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13 SIZES...

6½" to 1¼" Diameter Shafts

For your defense contract work, get Niagara presses to insure maximum output, long die life and uninterrupted production.

Widely employed in quantity production of small components for the aviation, ordnance and electronics industries.

Manufacturers of a complete line of sheet metal working equipment ranging from small hand tools up to large power operated machinery.

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*Cartridge Seal . . . pressure balanced . . . requiring only 25% more space than lip-type seals.

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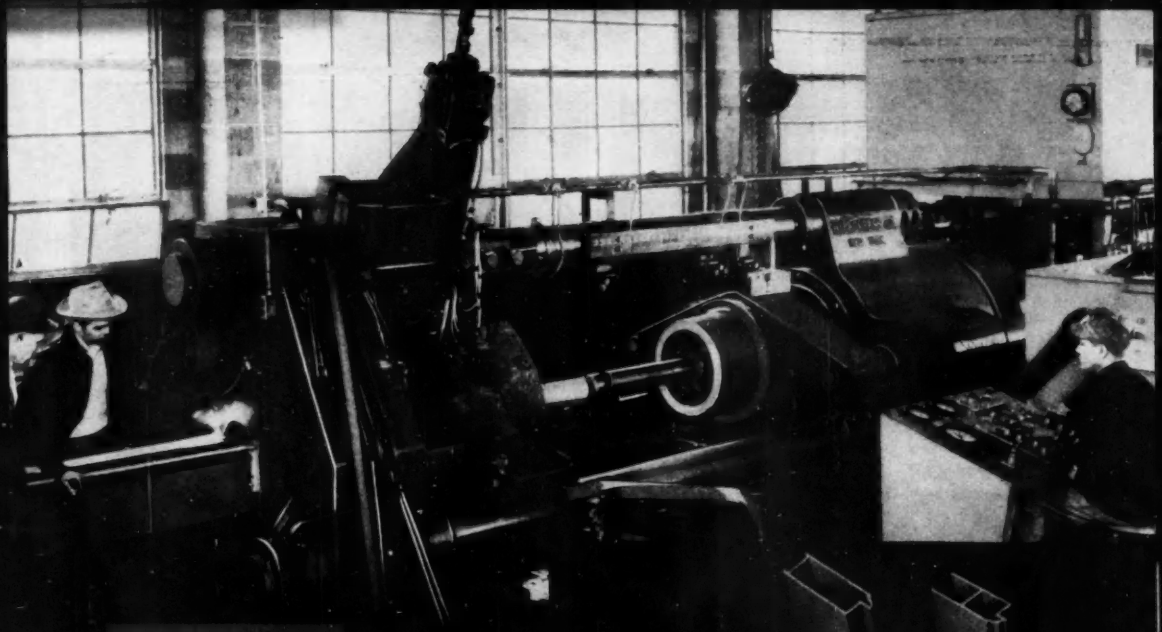
The Standard For Industry For Over 40 Years



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1,250 TON OIL-HYDRAULIC SELF-CONTAINED LOEWY-HYDROPRESS EXTRUSION INSTALLATION SUPPLIED TO the VALLEY METAL PRODUCTS CO., Plainwell, Michigan—Manufacturers of VAMPCO Aluminum Windows.

SAVE on equipment. A single Loewy-Hydropress installation rapidly and economically produces a wide variety of structural and ornamental shapes in light metals for the building, furniture, automotive and aircraft industries.

SAVE space. No need to store supplies of extruded stock. A quick die change on a Loewy-Hydropress Extrusion Press produces the desired shape in quantity for immediate requirements.

SAVE time. Transverse die slide cuts idle time between operations. This press design pioneered by Loewy-Hydropress, the result of years of experience, includes the latest improvements in the extrusion field.

CHECK THESE OUTSTANDING LOEWY-HYDROPRESS FEATURES • easy handling • simple design • full push button control • fast operation • high output • minimum personnel • small floor space • long stroke design giving space for easy loading of billets.

BUILT IN CAPACITIES UP TO 3000 TONS AND MORE

Write for details;
please specify your requirements.

LOEWY HYDROPRESS

OIL-HYDRAULIC, SELF-CONTAINED EXTRUSION PRESSES

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ENGINEERS & CONTRACTORS

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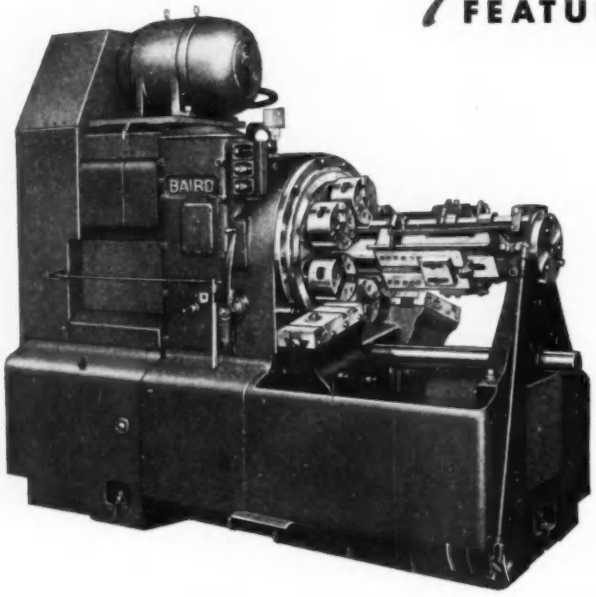
HIGH PRODUCTION TOOLING

BAIRD *automatic* CHUCKERS *provide*

7 FEATURES . . THAT SPELL FAST, CLOSE-LIMIT PRODUCTION



- ACCESSIBILITY . . . to all tooling
- VERSATILITY . . . for numerous operations
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- INDIVIDUAL TOOL SLIDES
- INDIVIDUAL Spindle Speeds
- AUTOMATIC CHUCKING . . . both hands free

The 7" chuck, 6 spindle, horizontal machine shown above has a production record that's hard to beat . . . in automotive, aircraft and other industries. It combines in a single automatic indexing cycle such operations as turning, facing, drilling, tapping, threading, grooving, chamfering . . . if desired . . . and performs with great accuracy at highly profitable speeds. All operations are automatic except loading and unloading . . . and both hands of the operator are free for this duty.

Automatic electrical and mechanical safety devices prevent damage when setting up, when loading is not within cycle time or when any motions are out of sequence.

For processing pistons, gears, pulleys, bushings, pump bodies, etc., the Baird 76 H Chucker will pay its way thru high production per man hour, reduced rejects, lower labor cost and increased dollar earnings per square foot of floor space. If you require such repetitive production, ask Baird engineers for practical recommendations.

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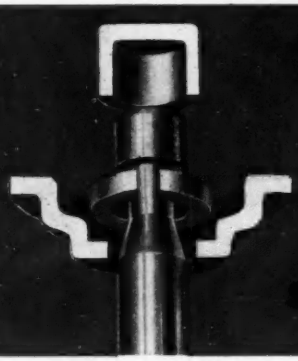
6 BASI



EATON FREE-VALVE

Prevents Valve Failure Due to Stem-Sticking and Face-Guttering

The Eaton Free-Valve is comprised of a special spring seat washer, a cap, a pair of flat half-circle keys, and a special valve stem shape. Normal tappet lash is maintained to accommodate valve expansion. The cam causes this lash to be taken up first; the tappet or rocker arm then (through the cap) lifts the spring retainer and spring, thus taking the load off the valve before lifting it.

Eaton Free-Valves can be applied to practically any engine without design changes. Eaton engineers will welcome an opportunity to discuss the application of Eaton Free-Valves to engines proposed or now in design.

Eaton Free-Valve Kits for Motor Cars, Trucks, and Tractors are available from dealers.

The Eaton Free-Valve is free of any restraining force set up by the spring, other than the normal vertical components necessary to control the rise and fall as dictated by cam motion. During a major portion of the lift cycle, valve motion is controlled, but the valve is free to float within the limits of the free-valve clearance.

This free-floating action keeps deposits from building up on the stem, guide, or seat faces. It also provides the motion necessary to keep a film of oil on the stem and guide surfaces, preventing scuffing and excessive wear. With the elimination of restraining forces, the normal tendency of the valve to creep causes it to take variable positions with respect to the seat at successive lift cycles.

The principal effects of this unrestricted motion are as follows:

1. Deposits commonly built up on the stem at the port end of the guide are continually wiped away.
2. Seat deposits are more uniform, and are held to a minimum.
3. Building up of excessive temperatures from local leakage due to deposits or distortion is prevented.

Performance records covering engines of all types in all kinds of service prove that Eaton Free-Valves can and do increase valve life by as much as *ten times* over the ordinary life expectancy of conventional valves. Write us for proof.

EATON MANUFACTURING COMPANY
CLEVELAND, OHIO
VALVE DIVISION: 9771 FRENCH ROAD • DETROIT 13, MICHIGAN

EATON PRODUCTS: Sodium Cooled, Poppet, and Free-Valves • Tappets • Hydraulic Valve Lifters • Valve Seat Inserts • Jet Engine Parts • Rotor Pumps • Motor Truck Axles • Permanent Mold Gray Iron Castings • Heater-Defroster Units • Snap Rings • Springtites • Spring Washers • Cold Drawn Steel • Stampings • Leaf and Coil Springs • Dynamatic Drives, Brakes, Dynamometers

WHAT'S THE BEST WAY TO STRIP PAINT FROM METAL PARTS TOO LARGE TO BE SOAKED IN TANKS?
See Page 3
OAKITE'S New FREE Booklet on Paint Stripping
how to STRIP PAINT
with Oakite Materials & Methods

OAKITE PRODUCTS, INC.
26 Thames St., New York 6, N. Y.

Send me a copy of your booklet *"How to STRIP PAINT"*

Also tell me (without obligation) about Oakite methods for the following jobs.

- ☐ Tank cleaning
- ☐ Machine cleaning
- ☐ Electrocleaning
- ☐ Pickling
- ☐ Pre-paint treatment
- ☐ Steam-detergent cleaning
- ☐ Burnishing
- ☐ Rust prevention

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answers many questions that will lead you to better stripping procedures. You'll want to read more about:

What's the best way to strip large areas of structural metal where a steam supply is available? *See page 5.*

What is the best method when steam is not available? *See page 7.*

What is the cheapest way to strip metal parts in large volume? *See page 9.*

What are the best ways to prepare stripped surfaces for repainting? *See page 11.*

What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? *See page 12.*

FREE For a copy of "How to STRIP PAINT" write to Oakite Products, Inc., 26 Thames St., New York 6, N. Y. This well-illustrated booklet describes four money-saving ways to remove paint:

1. **Oakite Steam Gun Method**
2. **Oakite Hot Flow-On Method**
3. **Oakite Cold Spray Method**
4. **Oakite Tank Immersion Method**

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Technical Service Representatives in Principal Cities of U. S. & Canada

A substantial saving in weight was realized by using Mayari R in construction of this Butler semi-trailer for Tide Water Associated Oil Company. This unit has six compartments and a total capacity of 6375 gallons.

They saved 1610 lb of Steel and added 230 gal capacity

In designing this semi-trailer gasoline tanker, Butler Manufacturing Company of Richmond, Calif., considered two different grades of steel: plain carbon, and Mayari R low-alloy, high-strength steel. Either grade could be used. And either one could meet the specifications that the Los Angeles Fire Commission has set for tankers of this type. But in the case of plain carbon steel, heavier gages and bulkier sections would be needed to meet the strength requirements.

They selected Mayari R. This allowed the use of thinner sections and reduced the weight of the vehicle by 1610 lb. This saving meant that they could add 230 gallons to the carrying capacity without exceeding the axle limits. An efficient, rugged semi-trailer, free of excess deadweight, is the result.

Mayari R has been used by builders of tankers, trailers and trucks of different types for the past fifteen years. It has the proper balance of mechanical properties and workability. It has excellent resistance to atmospheric corrosion. And it is priced at little more than plain carbon grades.

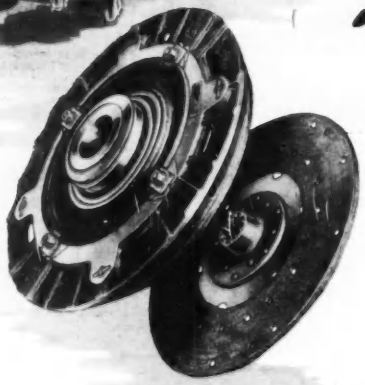
We suggest that you write for a copy of Mayari R Catalog 259, containing information on the properties, fabrication and applications of this versatile steel.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

Mayari R *makes it lighter... stronger... longer lasting*



Lipe CLUTCHES can take it!

Your drivers don't have to baby this rugged, heavy-duty, multi-lever clutch. And for good reason! There's just *one* spring and *20* equalizing levers. Result: pressure is evenly distributed all over the pressure plate . . . every part touches at the *same instant* with the *same pressure.*

These days, it's more important than ever to keep "down-time" to a minimum. Your service and repair shop will appreciate copies of our new Clutch Service Manual, and a free, large size wall chart detailing clutch adjustment procedure. Write for free copies.

For quick service on genuine Lipe parts, look for this ad in the yellow pages of the telephone directory in principal cities.

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Manufacturers of Automotive Clutches and Machine Tools

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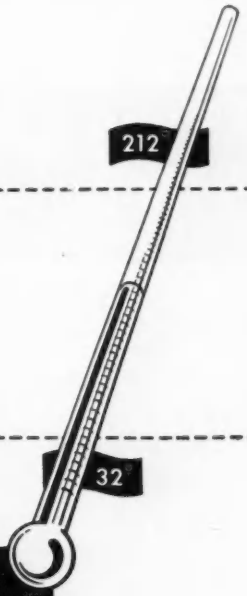
some like it HOT

some like it COLD



there's BONDERITE to work AT ANY TEMPERATURE

The operating temperature required for any given installation may be high or it may be low. Many factors are involved including type of metal being treated, plant conditions, and the like. Whatever temperature is *best* suited for your particular installation can be ascertained by our experts on corrosion control. We have a Bonderite product to suit your particular problem at whatever temperature is required.

Bonderite versatility is shown by the various products which we have developed to suit required temperatures — Bonderite 50, 95, 100, 120, 140, 160, 180, the numbers approximating in general the lowest temperature for optimum results in each case. As a matter of fact, good Bonderite coatings have been produced by solutions close to freezing and by solutions bubbling hot. There are Bonderite solutions operating *without heating coils* in the solution.

No matter what temperature your installation requires for best results, there is a Bonderite to fill the bill. We'll tell you how Bonderite, cold or hot, can deliver dependable, quality results at low cost.

Bonderite, as you know, is the most widely used, highest quality, corrosion resistant paint base phosphate coating for metals. It is also used as an aid in cold forming of metals. Write for free catalog. **Bonderite, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.*

PARKER

PARKER RUST PROOF COMPANY
2178 EAST MILWAUKEE
DETROIT 11, MICHIGAN

BONDERITE—*corrosion resistant paint base* • **PARCO COMPOUND**—*rust resistant*
BONDERITE and BONDERLUBE—*aids in cold forming of metals* • **PARCO LUBRITE**—*wear resistant for friction surfaces*

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- YOU and your family can enjoy the famous "Southern Hospitality"—a new joy in living.

YOU can begin a NEW CAREER,
with unexcelled opportunities for the future.

YOU can SERVE YOUR COUNTRY
by becoming an important part of its defense activities.

All this YOU can do—if you can qualify for opportunities now open in LOCKHEED'S Georgia Division long-range production program.

GET IN ON THE GROUND FLOOR IN THESE KEY POSITIONS:

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594½ PEACHTREE ST., N. E.
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LOCKHEED
AIRCRAFT
CORPORATION
GEORGIA DIVISION
MARIETTA, GEORGIA

WHY GET INVOLVED...

in special design, drawings, tools, parts or any other "specials"? They almost always *increase costs, delay deliveries, reduce profits—"put you in the RED".*

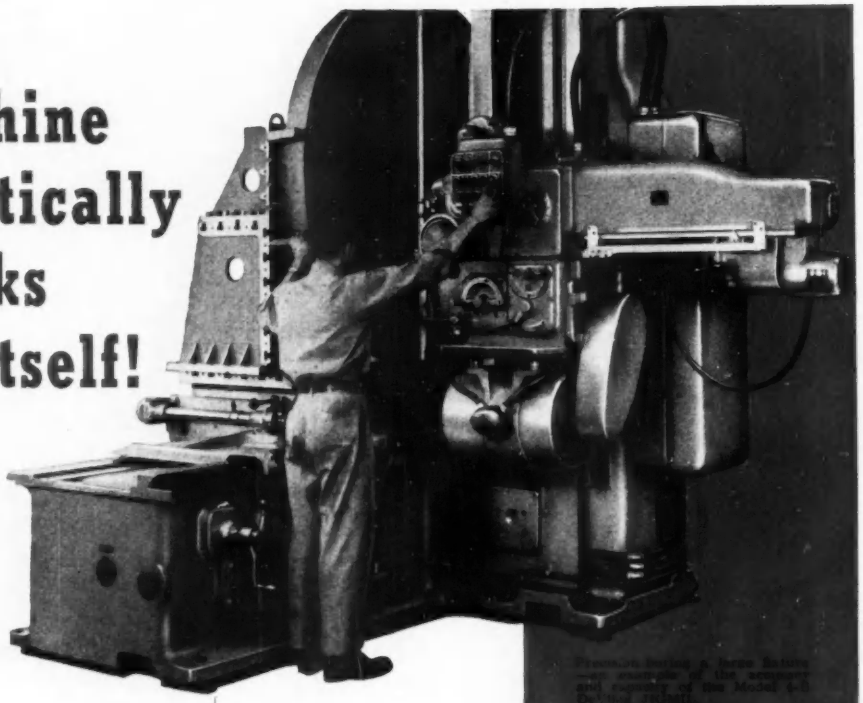
Whenever you use socket screw products—be sure you're not specifying "specials" where "standards" will do. Let us tell you how UNBRAKO Standard Socket Screw products—stocked by your local UNBRAKO Distributor—can help to *"keep you in the BLACK".* They're listed and described in our booklet, UNBRAKO "STANDARDS". Write for *your* copy today.

STANDARD recommends UNBRAKO® "Standards"

Knurled Head Socket Cap Screws
Flat Head Socket Cap Screws
Self-Locking Socket Set Screws
Knurled Head Shoulder Screws
Precision-Ground Dowel Pins
Fully-Formed Pressure Plugs

SPS — STANDARD PRESSED STEEL CO. — JENKINTOWN 52, PENNSYLVANIA

This machine practically thinks for itself!

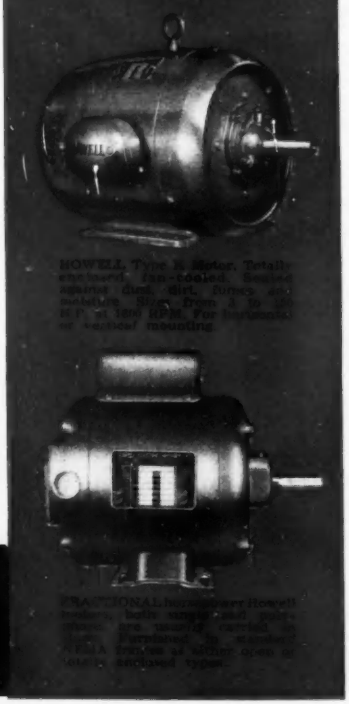


It's uncanny the way this DeVlieg JIGMIL handles the most complex boring and milling operations *automatically*, simply by pushing a button on the control panel.

For example — by simple push button control, the workpiece is positioned both horizontally and vertically, and holes are automatically spaced and bored to exact tolerances. A unique index table allows machining of parts from four sides without rechucking. A power tool lock permits locking or releasing cutting tools in a few seconds.

Howell engineers worked closely with this manufacturer to make sure each of the five Howell motors fitted its job exactly. The three 2-speed and two single-speed Howell motors make a vital contribution to the remarkable efficiency of this machine.

Howell will supply the same high degree of engineering skill and experience to your problems. You are assured of quality motors designed for your specific requirements, built to stand up under the heaviest production loads. May we handle your electric motor needs?



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HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built industrial motors since 1915

Easier to make hard parts like these . . .

with 52100 steel!

52100 steel, widely used for anti-friction bearings, is hard and tough, yet, it's easy to machine! As a result, it's an ideal material for parts like those shown above—slitting knives, machine tool parts, pump parts, mechanical seals, lathe centers, mill rolls—and many others.

52100 has extreme hardenability throughout its cross section, high tensile strength, high fatigue strength. Fully spheroidized structure makes machining easier. It can be oil quenched to a maximum hardness of 65/66 Rockwell C. and will withstand a working pressure of 200,000 p.s.i.

Close quality control at every step in production insures uniformity in every lot of Timken® 52100 steel.

The Timken Company is the only source of 52100 in three finished forms--bars, tubing, and wire. For small runs or emergency requirements, the Timken Company maintains a mill stock of 101 sizes, from 1" to 10½" O.D. Shipment is made within 24 hours after your order is received.

For stock list of available sizes, grades, and finishes, write The Timken Roller Bearing Co., Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing

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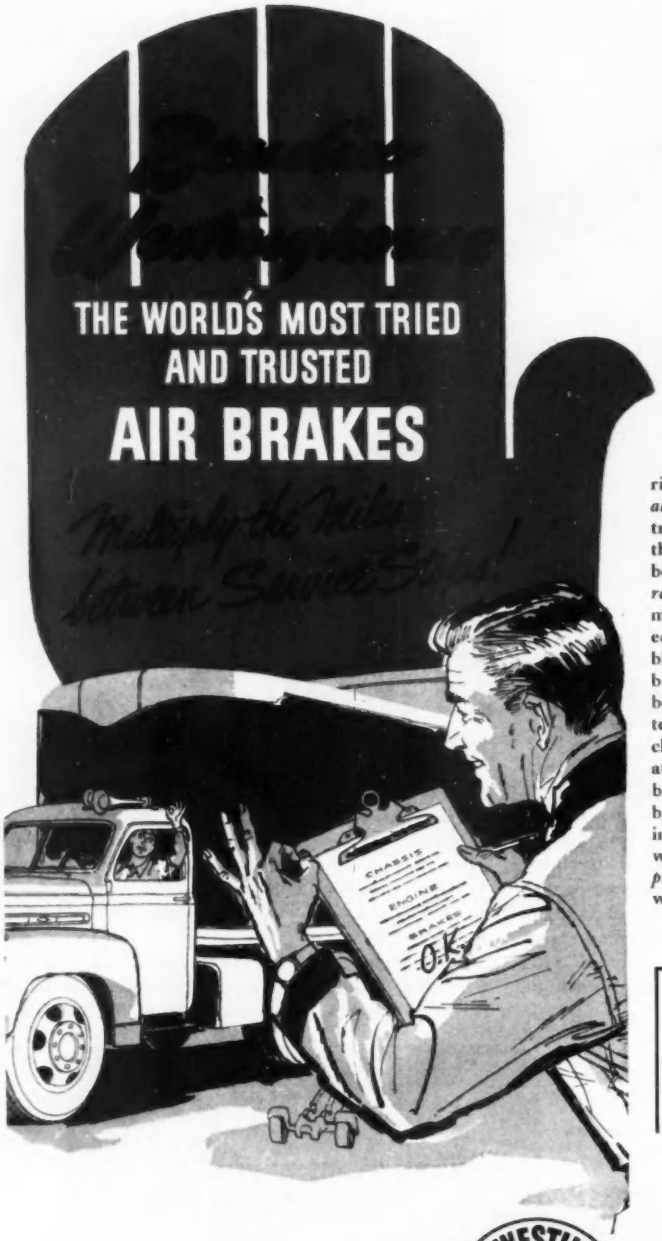
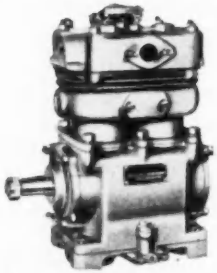


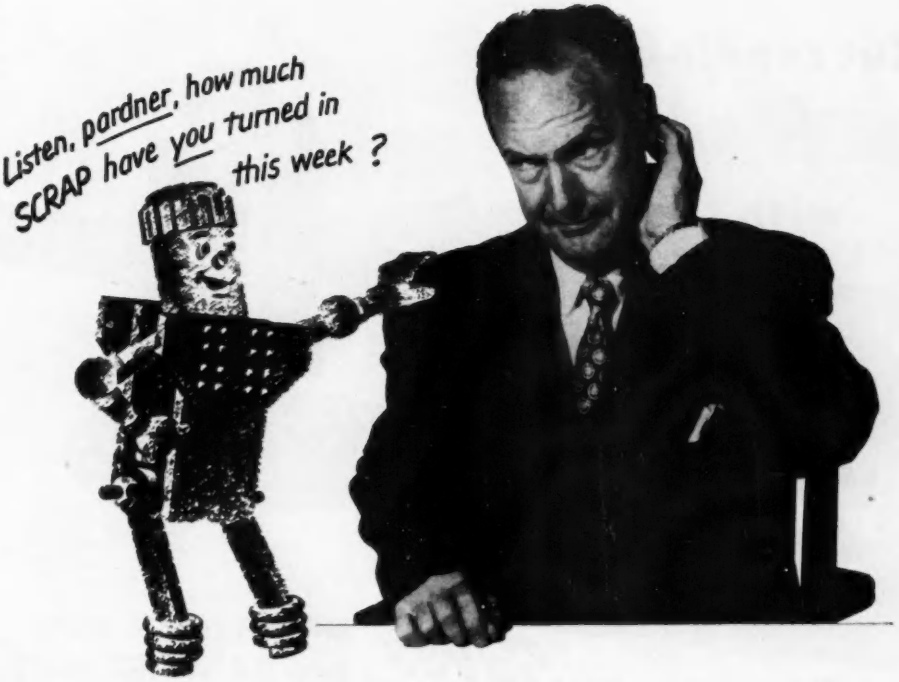
WHEN YOU SPECIFY BENDIX-WESTINGHOUSE AIR BRAKES for your trucks or buses, you can do so with the complete confidence that comes with making the best choice—*and knowing it!* Your judgment is backed by the fact that no other brake in the field has rolled up such an outstanding record of superiority over billions of miles traveled on *all* kinds of hauling jobs. And, as most truck and bus operators will tell you, this remarkable record goes farther than better braking performance alone. The *real* pay-off to these practical businessmen comes in the cost cutting economy—economy that results from rugged, durable construction and a smooth, constant braking effort that multiplies the miles between service stops and decreases maintenance costs on linings, drums, tires and chassis while actually *increasing* their operating life! That's because these mighty brakes are built to the highest standards by the most experienced manufacturer in the business. Take advantage of it—when you specify Air Brakes, specify the *proven* brakes—Bendix-Westinghouse, the world's most tried and trusted air brakes.



The Bendix-Westinghouse Compressor—heart of the air brake system—performance proven over more miles on more installations than any other compressor available!

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE COMPANY
ELYRIA, OHIO

BENDIX-WESTINGHOUSE AIR BRAKES
REG. U. S. PAT. OFF.



Today, the steel business is your business

—*it needs all your SCRAP, Now!*

SUPPOSE that every steel user were suddenly told that he had to turn in a half-ton of scrap before he could get a ton of steel. It would start the most gosh-almighty treasure hunt for scrap that ever happened.

In effect, this "no-scrap, no-steel" situation virtually exists. For without *all* the scrap that industry can search out and start on its way to the mills, steel production will surely drop. It's as serious as that.

More scrap is urgently needed. Today the mills are turning out more steel than ever before. But they're scraping the bottom of the barrel as far as scrap is concerned. Defense and domestic demands for steel simply cannot be met unless at least 100,000 tons of "purchased" scrap roll into the furnaces—*every day.*

The bulk of this scrap must come from industry. That's why we're asking for your all-out help. That's why it's so important that you make the drive for scrap part of your daily operations. Make it your business to encourage every employee to report any obsolete, broken or worn-out machinery, tool or equipment that has seen its day. From this dormant "junk" must come the heavy melting scrap that the mills need most. Don't let your scrap lie idle; send it on its way. How about it, pardner?

You'll find your local scrap dealers listed in the yellow pages of the phone directory.

This page would ordinarily be used to tell you about

U·S·S CARILLOY STEELS

but, because without SCRAP we cannot produce steel, we are asking instead for your all-out help in getting more SCRAP to the mills.

UNITED STATES STEEL COMPANY, PITTSBURGH • COLUMBIA STEEL COMPANY, SAN FRANCISCO
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UNITED STATES STEEL

Cut sanding costs in *Half* with the

CLECO

1480-A HIGH-SPEED

PNEUMATIC SANDER

Saves OPERATORS' TIME and SANDING DISCS

Air power can help you cut your production costs, whether your job is sanding, grinding, scaling, drilling, screwdriving or nut running. A word from you will put a Cleco Field Engineer on your job immediately. Write today.

The Cleco 1480-A High-Speed Sander is the fastest and most economical tool yet developed for cleaning up stainless steel welds.

As an example, a Diesel locomotive manufacturer was using a heavy, slow-speed sander to finish off light welds. Sanding took 15 minutes and three to four sanding discs. With the Cleco 1480-A High-Speed Pneumatic Sander, the job was done in seven and a half minutes with only one disc.

Operator fatigue can also be greatly reduced, since the Cleco 1480-A weighs only eight pounds.

CLECO AIR TOOLS

* Wheel guard furnished so grinder may be used with hard wheels.

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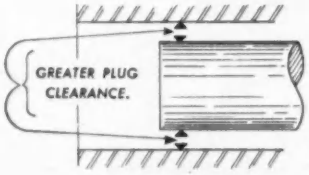
AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

LET'S GET IT STRAIGHT!

The "DIMENSIONAIR" Air Gage —

EACH GRADUATION IS .00005"
AND NO DOUBT ABOUT IT.

LONGER PLUG WEAR
because of greater JET clearance.



IS calibrated accurately over its entire range

IS set accurately with only <u>one</u> master

HAS a range of .003" with 2500 to 1 magnification

HAS much longer plug wear

HAS greater plug clearance so that the same plug can be used on <u>both</u> rough and finished dimension

REMAINS <u>stable</u> for long periods of time

YES, LET'S GET IT STRAIGHT, the Dimensionair uses its own operating principle and new mechanical devices which do away with the limitations common to previous types of air gages.

ACTUAL SIZE: 9" x 7⅛" x 8½"
WEIGHT 17¾ LBS.

FEDERAL DIMENSIONAIR PROVES ITSELF

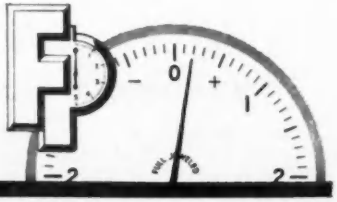
Why not find out to your own satisfaction what the Federal Dimensionair will do for you! Put it to work—discover how the exceptional measuring range of .003" lets you gage irregular shaped and tapered holes. Oil or coolants won't affect the Dimensionair: grit and dirt won't clog it: rough handling won't harm it.

Find out how the Dimensionair can do all this and more—ask our nearest representative to show you the Federal way to better, more positive air gaging, or write to us for complete information and prices.

FEDERAL PRODUCTS CORPORATION,
2612 Eddy Street, Providence 1, Rhode Island

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing <u>all types</u> of DIMENSIONAL INDICATING GAGES



THE BULLDOG PLAN . . . A HIT WITH SWITCH USERS!

Samson
FOLDING TABLES AND CHAIRS

SHWAYDER BROS., INC.
4270 HIGH ST., ECORSE STATION DETROIT 29, MICHIGAN
FOLDING FURNITURE DIVISION

October 25, 1951

Bulldog Electric Products Company
7610 Joseph Campau Avenue
Detroit, Michigan

Gentlemen:

I have just been informed by our Purchasing and Maintenance Departments of the substantial savings in money and time we are already gaining through your safety switch simplification program. It is the kind of a report that is a pleasure to hear.

For example, prior to your program we were compelled to stock many different safety switch catalogue numbers to insure continuous production in the event of emergencies, or for normal replacement needs. Now we have reduced these inventories to a new low. This was possible only, I am told, because each switch in your simplified line replaces any one of several switches formerly required.

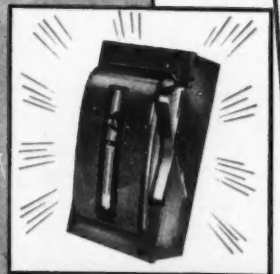
Such simplification is beneficial to us and other industrial plants for easing the problems of procurement and maintenance in these days of increasing shortages.

In addition, we appreciate the fact that these top-grade switches are available at medium-grade switch prices.

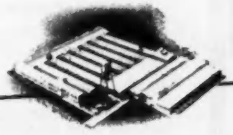
We strive to reduce every item of overhead expense and appreciate the cooperation of companies like yourself that help us to accomplish this through standardization and simplification.

Sincerely,

SHWAYDER BROTHERS, INC.
Benjamin H. Shwayder
Vice President



A TYPE A SWITCH
AT TYPE C PRICES



DENVER DETROIT
Also Manufacturers of Samsonite Luggage, Denver Colorado

Safety switch users from all across the country are writing enthusiastic letters like this to BullDog . . . hailing the added convenience, slashed costs and substantial savings effected by the BullDog program of safety switch simplification.

There's every chance that *you*, too, will get similar benefits by ordering, stocking and using the new, simplified line of BullDog Vacu-Break Master Safety Switches.

Write Dept. 453-B for descriptive folder.

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DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES
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They are corrected daily, for the highest attainable degree of accuracy.

They are cross-checked for the elimination of all discernible duplication.

They are maintained by our trained force of list compilers, most of whom do nothing else during each working day; many of whom have been doing it without interruption since the inception of these lists 30 years ago.

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Write for free data file.

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in inch ounces
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All sizes from 0-6000 ft. lbs.)

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Specified because Electrofilm "built-in" lubrication takes up where ordinary methods are not practical or adequate, due to temperature, solvents, inaccessibility, etc.

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Quality Stampings 225 ton capacity, 5⅞ in. draw

THE H AND P DIE and STAMPING CO.

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Engineers with five years or more design experience in the automotive field, particularly with motor trucks or industrial lift trucks. In reply please give complete educational background and details of work performed for past employers. Location Pacific Northwest.

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Simply brush on right at bench ready for layout in few minutes. Dark blue background makes scribed layout lines show up in sharp relief. Also prevents metal glare, increasing efficiency and accuracy. Write for details.

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TRACK SUPPLIES · STRUCTURAL STEEL · RAILS

RAILS *New and Relaying!*

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Safety **CONTROLS** FOR ENGINES

SYNCHRO-START PRODUCTS, INC.

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Fellows

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BESLY-TITAN ABRASIVE WHEELS

Made to Meet Your Individual Production Requirements

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Up to 5/8 inch

AUTOMATIC SCREW MACHINES
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All type bolts, nuts, screws

We Manufacture a Complete Line of
A-N HYDRAULIC FITTINGS & A-N BOLTS, NUTS, SCREWS & PINS
Especially Equipped for Precision Quantity Production

DIAL SCREW PRODUCTS CO., INC.
32-20 — 58th St., Woodside, N. Y. C.

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Abbott — world's largest manufacturer of *deep hardened* and *tempered* carbon steel Bearing Balls — extends best wishes to friends and customers.

May we serve and help you in the years ahead?

THE ABBOTT BALL COMPANY
35 Railroad Place, Hartford 10, Conn.

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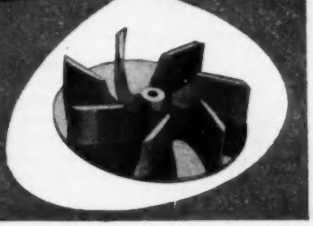

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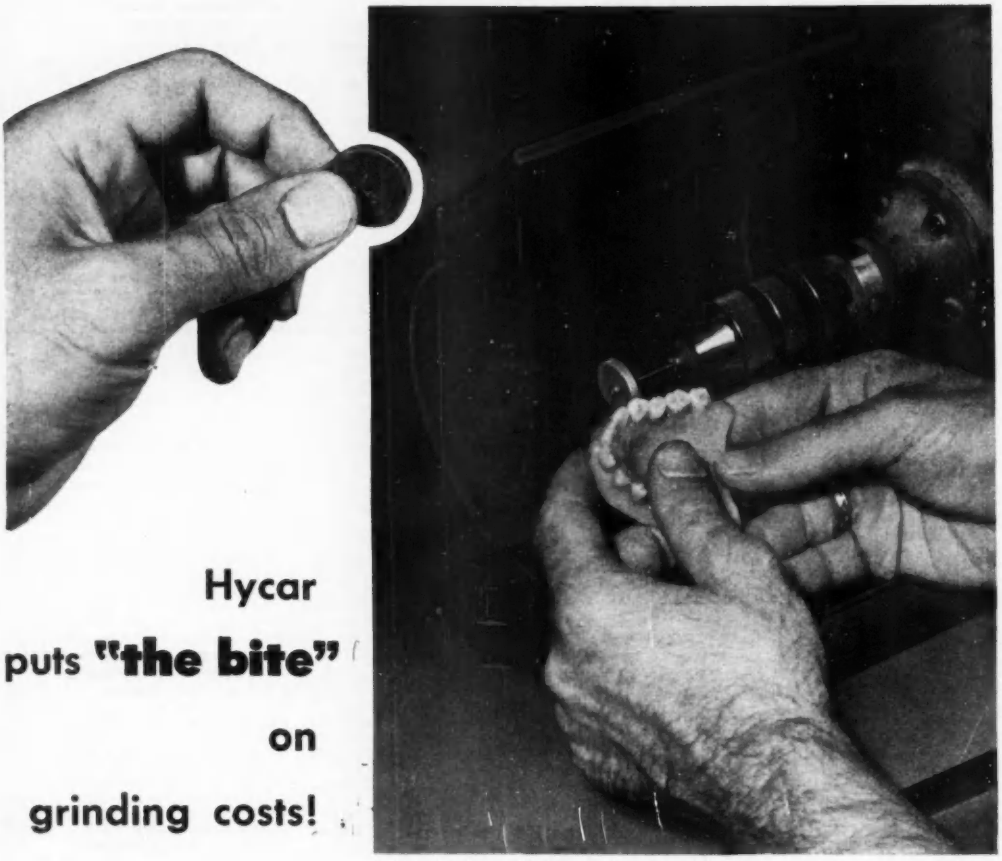

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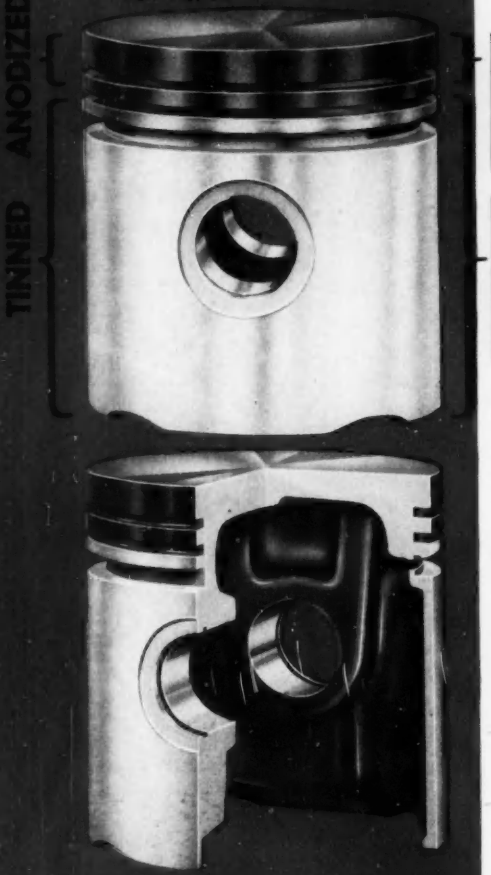

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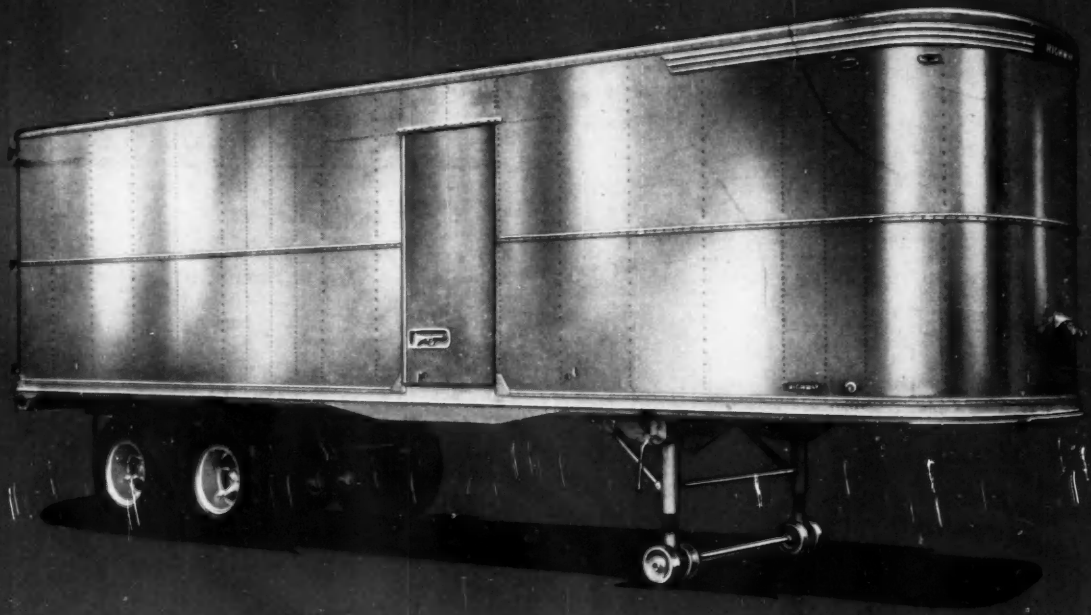

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